FIG. 1

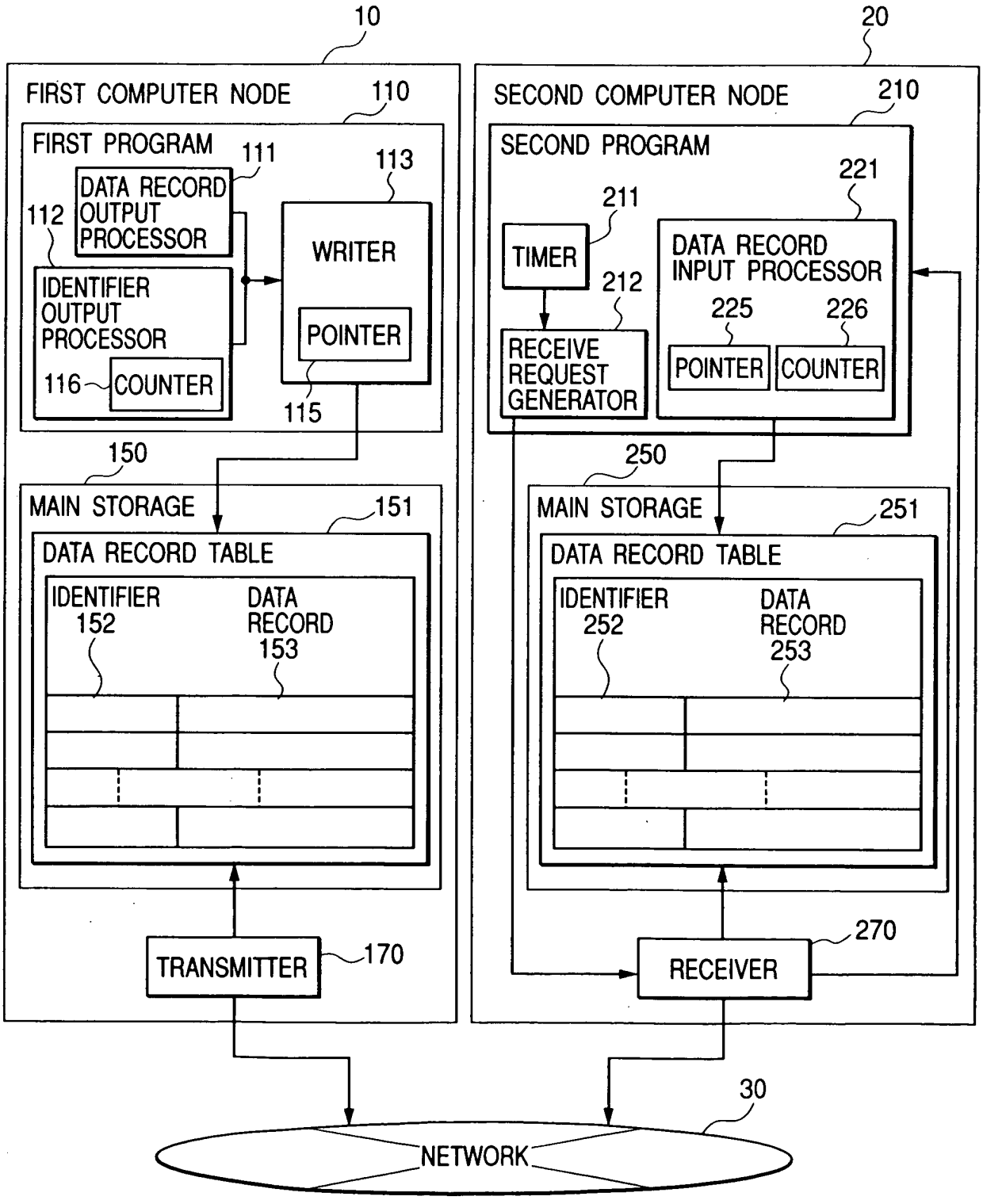

10
20
FIRST COMPUTER NODE
110
SECOND COMPUTER NODE
210
FIRST PROGRAM
111
113
DATA RECORD OUTPUT PROCESSOR
112
WRITER
IDENTIFIER OUTPUT PROCESSOR
POINTER
116
COUNTER
115
SECOND PROGRAM
221
211
TIMER
DATA RECORD INPUT PROCESSOR
212
225
226
RECEIVE REQUEST GENERATOR
POINTER
COUNTER
150
250
MAIN STORAGE
151
MAIN STORAGE
251
DATA RECORD TABLE
DATA RECORD TABLE
IDENTIFIER 152
DATA RECORD 153
IDENTIFIER 252
DATA RECORD 253
TRANSMITTER
170
RECEIVER
270
30
NETWORK

FIG. 2

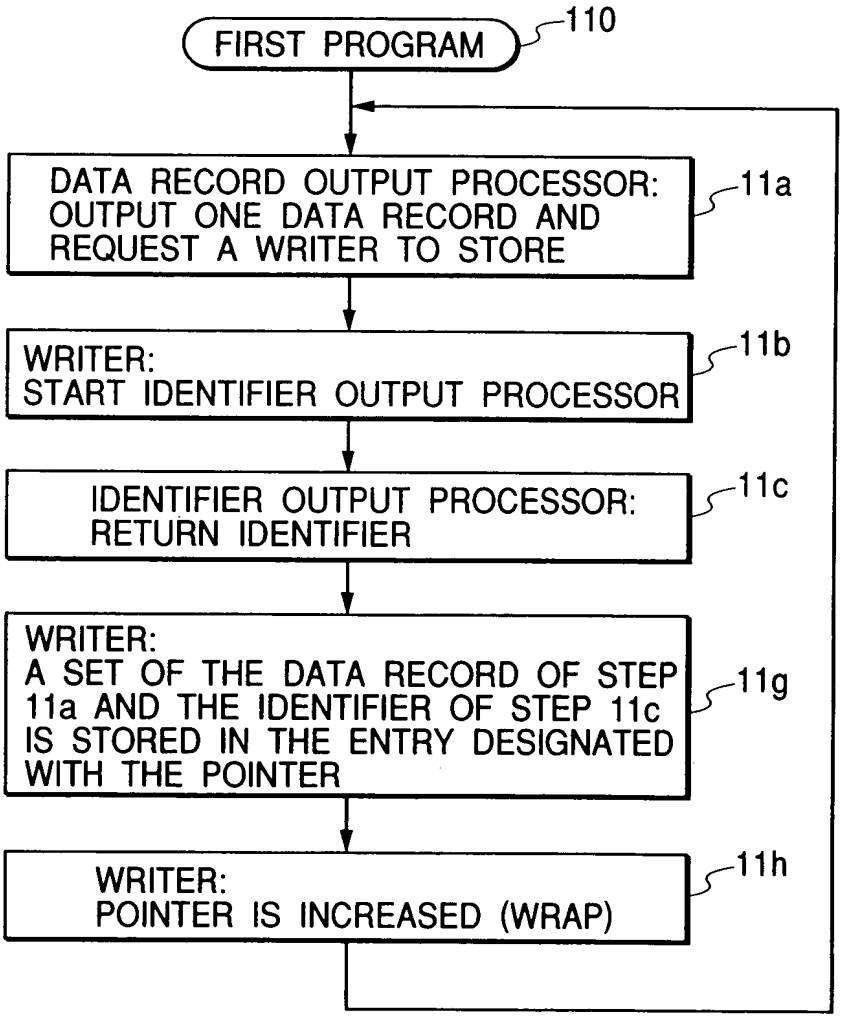

FIRST PROGRAM
110
DATA RECORD OUTPUT PROCESSOR: OUTPUT ONE DATA RECORD AND REQUEST A WRITER TO STORE
11a
WRITER: START IDENTIFIER OUTPUT PROCESSOR
11b
IDENTIFIER OUTPUT PROCESSOR: RETURN IDENTIFIER
11c
WRITER: A SET OF THE DATA RECORD OF STEP 11a AND THE IDENTIFIER OF STEP 11c IS STORED IN THE ENTRY DESIGNATED WITH THE POINTER
11g
WRITER: POINTER IS INCREASED (WRAP)
11h

FIG. 3

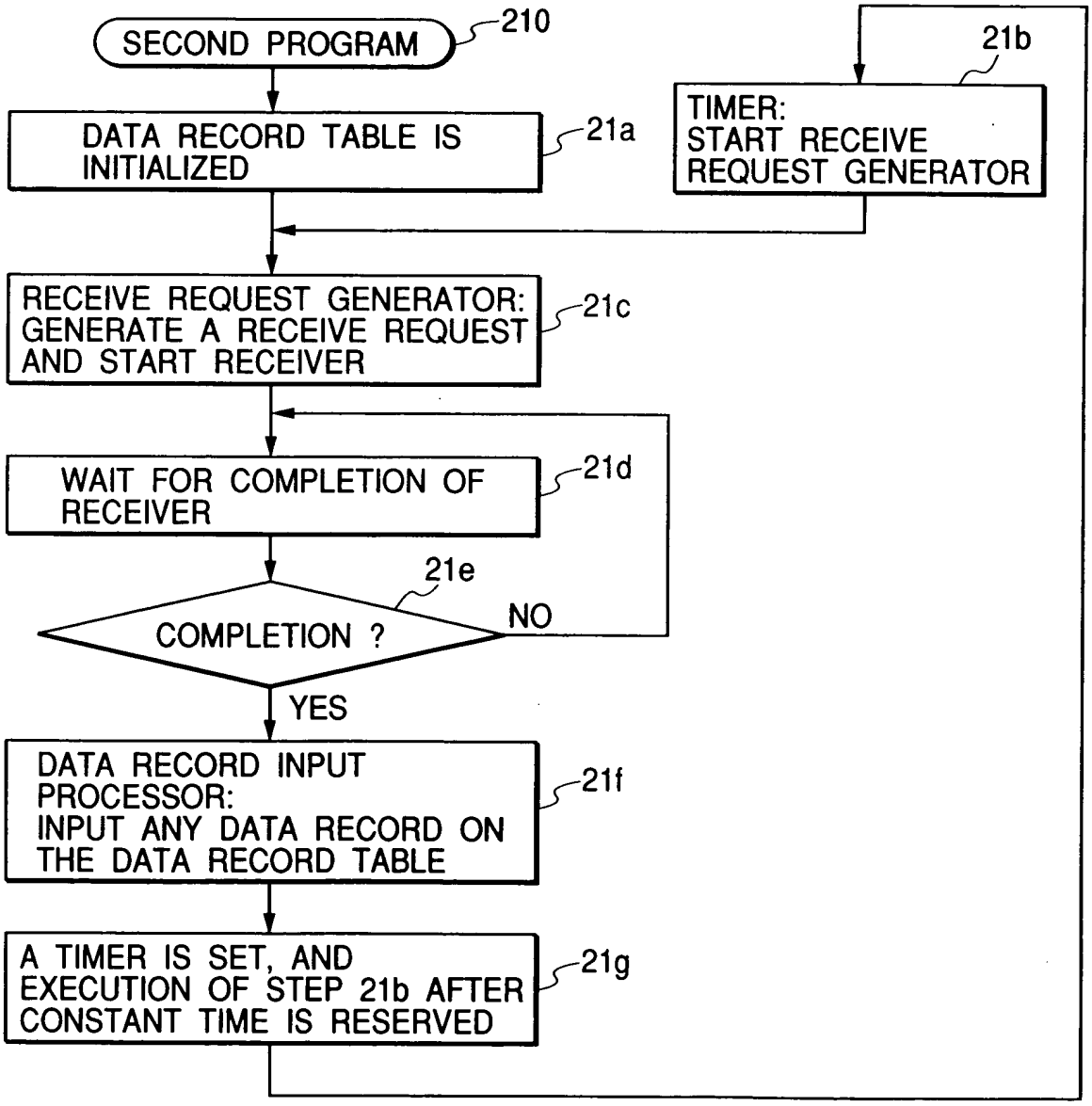

SECOND PROGRAM
210
DATA RECORD TABLE IS INITIALIZED
21a
TIMER: START RECEIVE REQUEST GENERATOR
21b
RECEIVE REQUEST GENERATOR: GENERATE A RECEIVE REQUEST AND START RECEIVER
21c
WAIT FOR COMPLETION OF RECEIVER
21d
COMPLETION ?
21e
NO
YES
DATA RECORD INPUT PROCESSOR: INPUT ANY DATA RECORD ON THE DATA RECORD TABLE
21f
A TIMER IS SET, AND EXECUTION OF STEP 21b AFTER CONSTANT TIME IS RESERVED
21g

FIG. 4

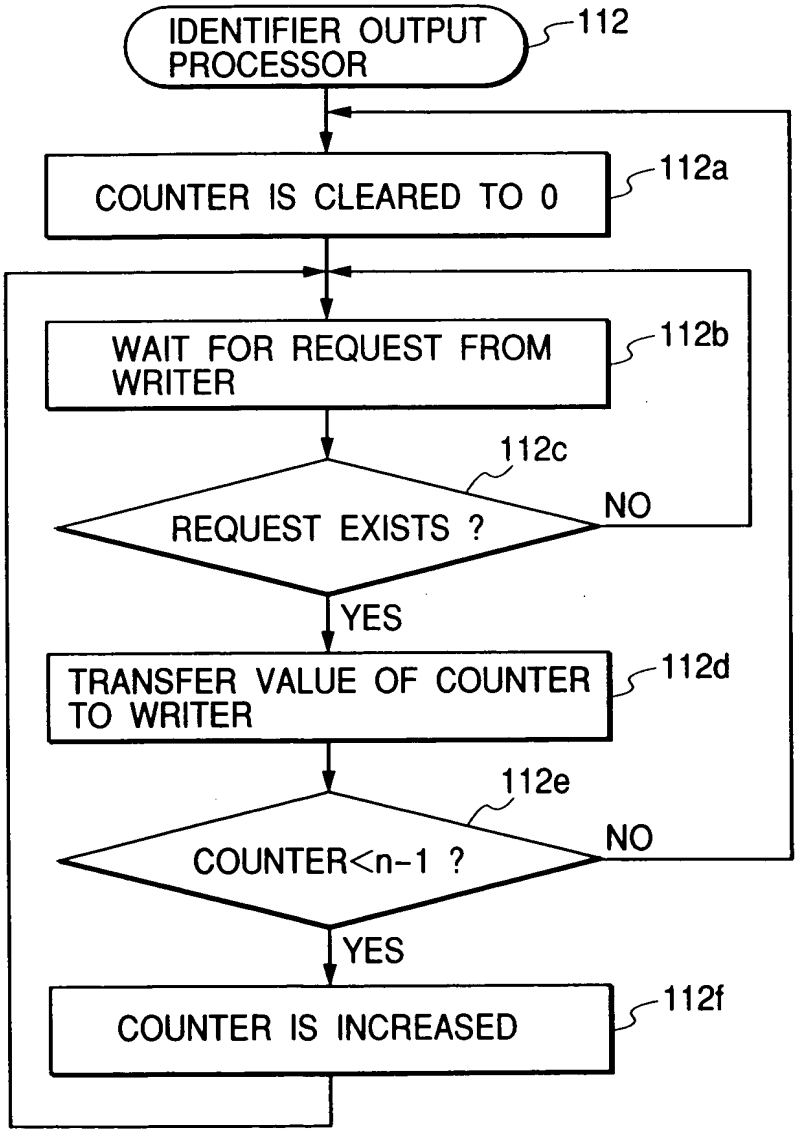

IDENTIFIER OUTPUT PROCESSOR
112
COUNTER IS CLEARED TO 0
112a
WAIT FOR REQUEST FROM WRITER
112b
112c
REQUEST EXISTS ?
NO
YES
TRANSFER VALUE OF COUNTER TO WRITER
112d
112e
COUNTER<n-1 ?
NO
YES
COUNTER IS INCREASED
112f

FIG. 5

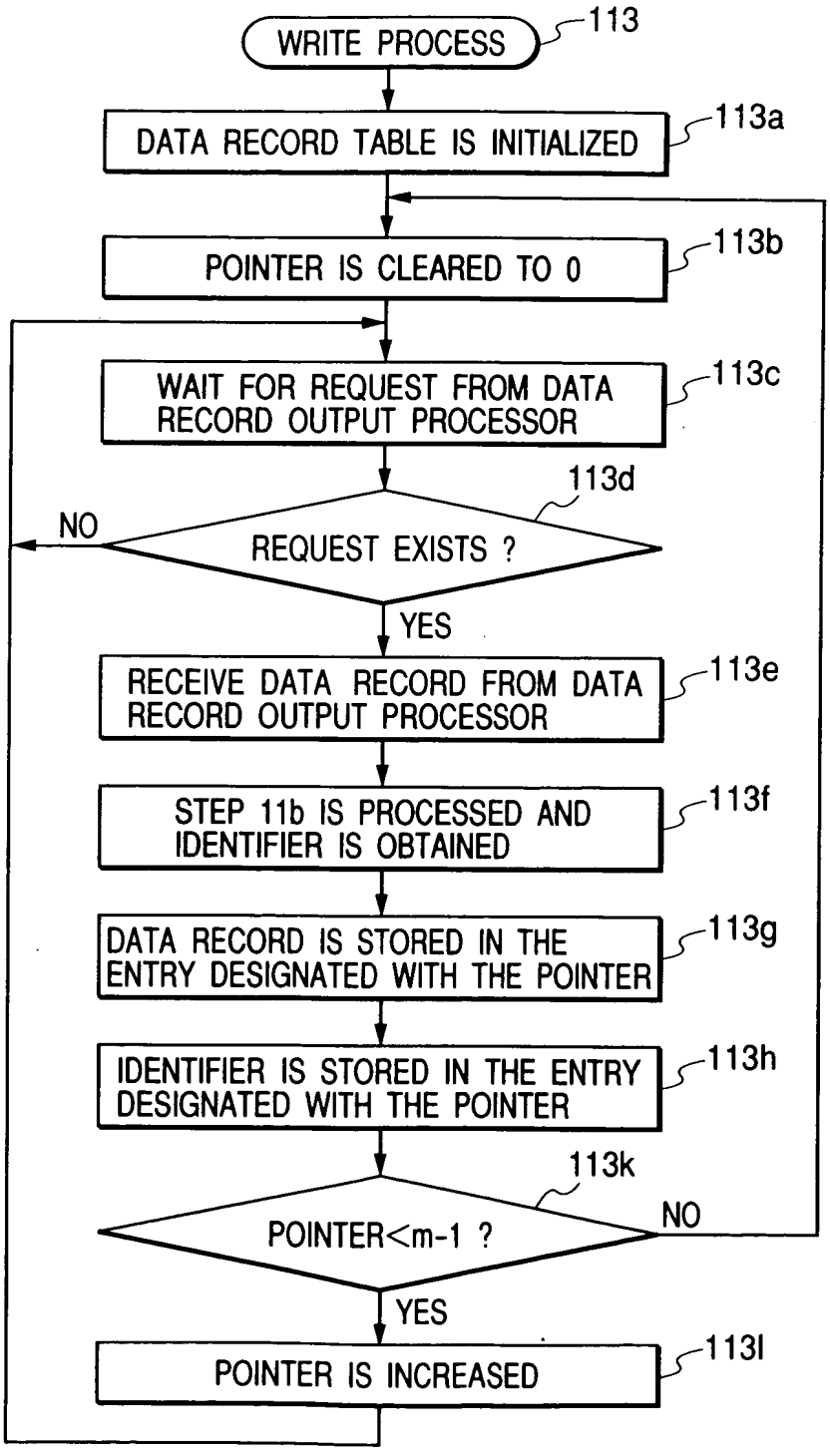

WRITE PROCESS
113
DATA RECORD TABLE IS INITIALIZED
113a
POINTER IS CLEARED TO 0
113b
WAIT FOR REQUEST FROM DATA RECORD OUTPUT PROCESSOR
113c
113d
REQUEST EXISTS ?
NO
YES
RECEIVE DATA RECORD FROM DATA RECORD OUTPUT PROCESSOR
113e
STEP 11b IS PROCESSED AND IDENTIFIER IS OBTAINED
113f
DATA RECORD IS STORED IN THE ENTRY DESIGNATED WITH THE POINTER
113g
IDENTIFIER IS STORED IN THE ENTRY DESIGNATED WITH THE POINTER
113h
113k
POINTER<m-1 ?
NO
YES
POINTER IS INCREASED
113l

FIG. 6

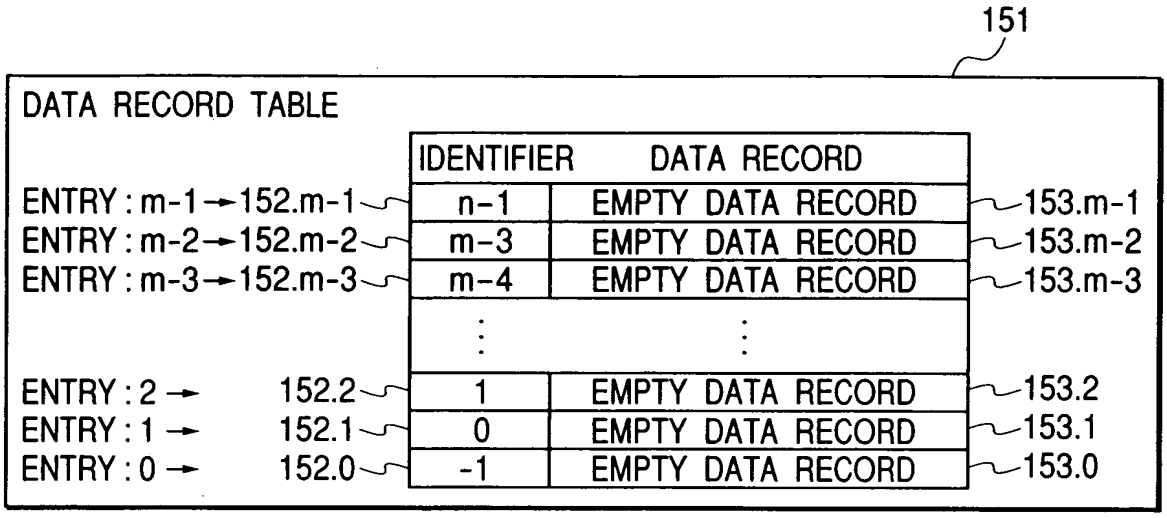

151
DATA RECORD TABLE
IDENTIFIER
DATA RECORD
ENTRY : m-1 → 152.m-1
ENTRY : m-2 → 152.m-2
ENTRY : m-3 → 152.m-3
n-1
m-3
m-4
EMPTY DATA RECORD
153.m-1
153.m-2
153.m-3
ENTRY : 2 → 152.2
ENTRY : 1 → 152.1
ENTRY : 0 → 152.0
1
0
-1
153.2
153.1
153.0

FIG. 7

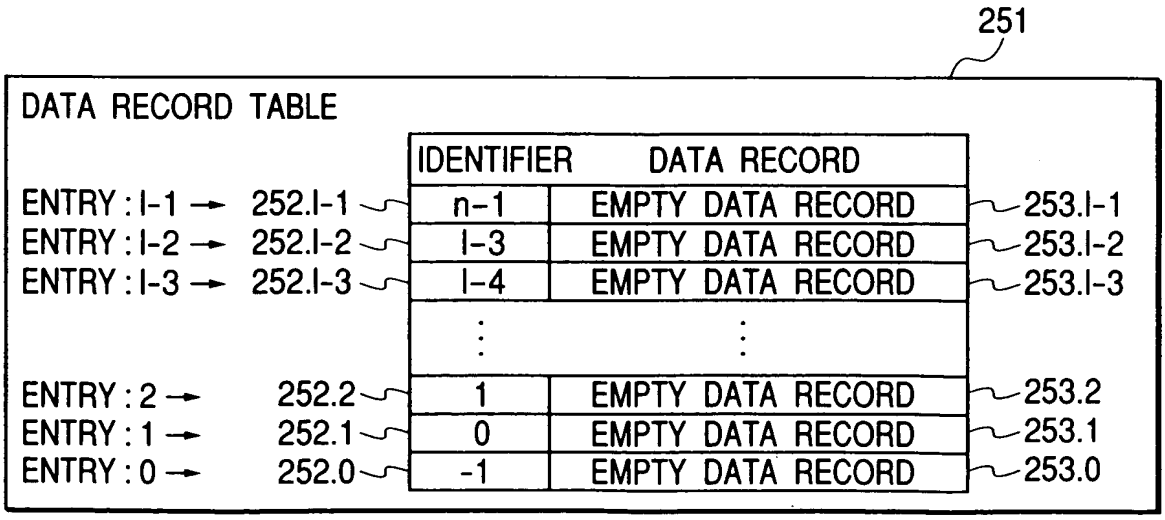

251
DATA RECORD TABLE
IDENTIFIER
DATA RECORD
ENTRY : I-1 → 252.I-1
ENTRY : I-2 → 252.I-2
ENTRY : I-3 → 252.I-3
n-1
I-3
I-4
EMPTY DATA RECORD
253.I-1
253.I-2
253.I-3
ENTRY : 2 → 252.2
ENTRY : 1 → 252.1
ENTRY : 0 → 252.0
1
0
-1
253.2
253.1
253.0

FIG. 8

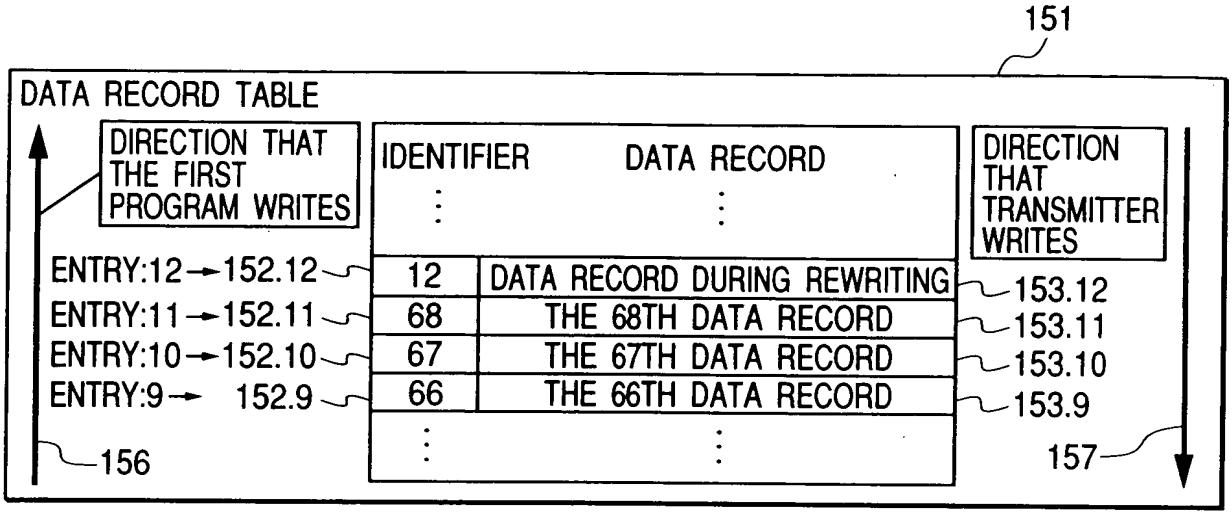

151
DATA RECORD TABLE
DIRECTION THAT THE FIRST PROGRAM WRITES
IDENTIFIER
DATA RECORD
DIRECTION THAT TRANSMITTER WRITES
ENTRY:12 → 152.12
ENTRY:11 → 152.11
ENTRY:10 → 152.10
ENTRY:9 → 152.9
12
DATA RECORD DURING REWRITING
153.12
68
THE 68TH DATA RECORD
153.11
67
THE 67TH DATA RECORD
153.10
66
THE 66TH DATA RECORD
153.9
156
157

FIG. 9

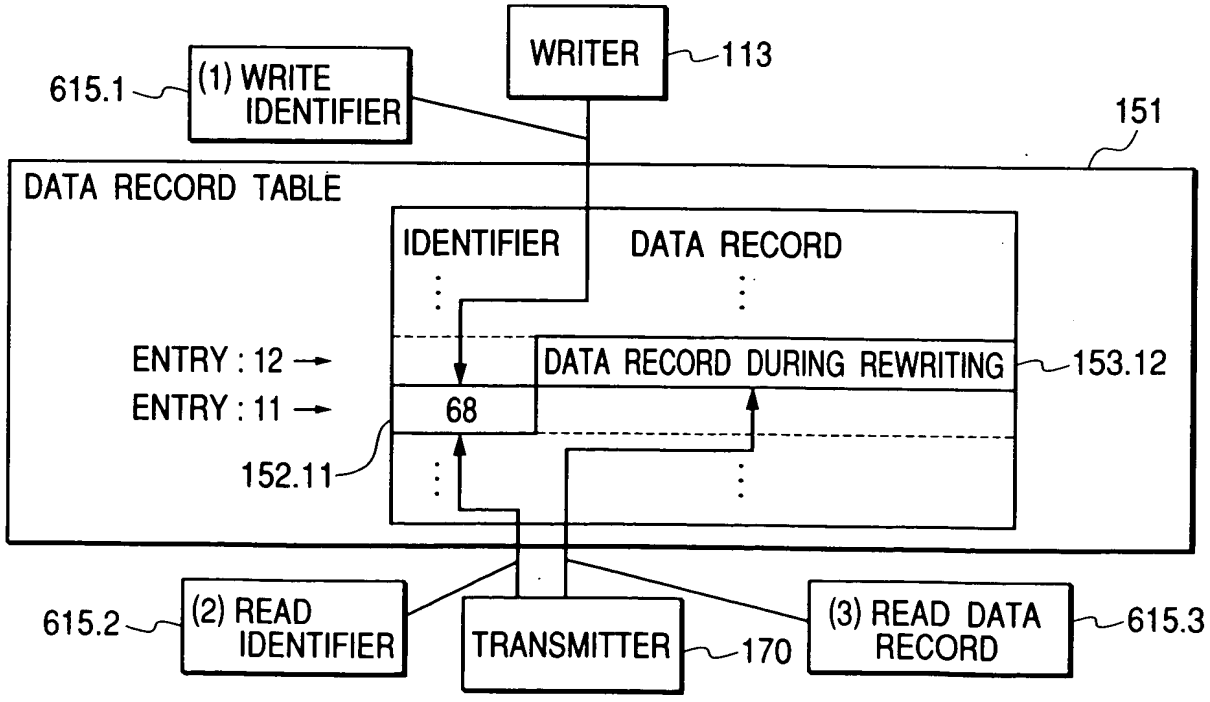

WRITER
113
615.1
(1) WRITE IDENTIFIER
151
DATA RECORD TABLE
IDENTIFIER
DATA RECORD
ENTRY : 12 →
ENTRY : 11 →
DATA RECORD DURING REWRITING
153.12
68
152.11
615.2
(2) READ IDENTIFIER
TRANSMITTER
170
(3) READ DATA RECORD
615.3

FIG. 10

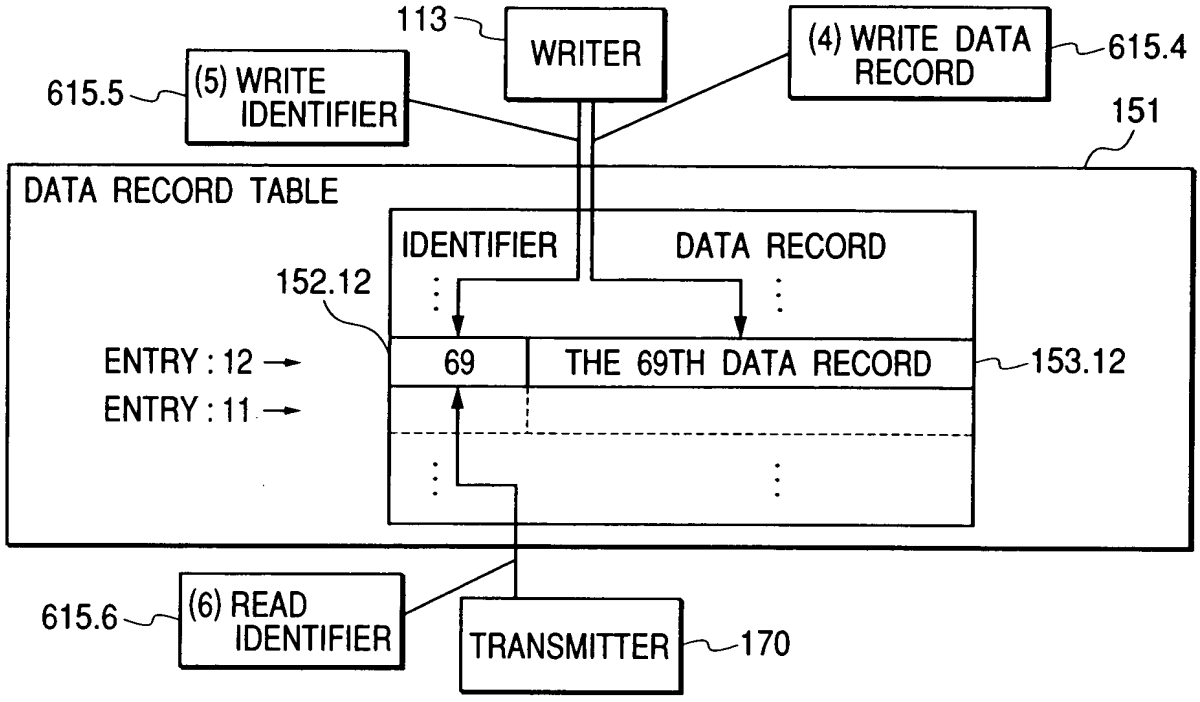

113
WRITER
(4) WRITE DATA RECORD
615.4
615.5
(5) WRITE IDENTIFIER
151
DATA RECORD TABLE
IDENTIFIER
DATA RECORD
152.12
ENTRY : 12
ENTRY : 11
69
THE 69TH DATA RECORD
153.12
615.6
(6) READ IDENTIFIER
TRANSMITTER
170

FIG. 11

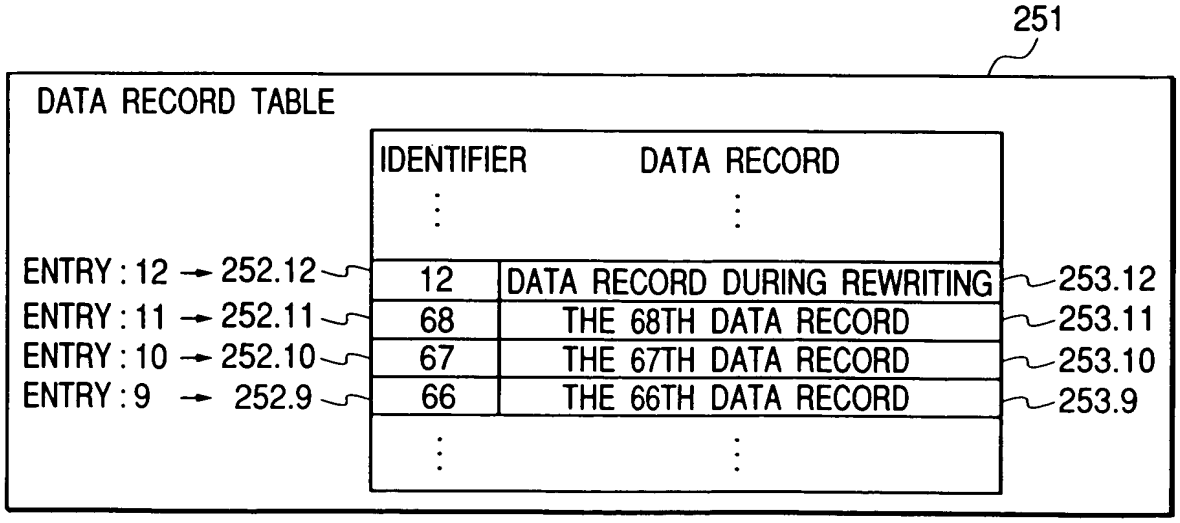

251
DATA RECORD TABLE
IDENTIFIER
DATA RECORD
ENTRY : 12 → 252.12
ENTRY : 11 → 252.11
ENTRY : 10 → 252.10
ENTRY : 9 → 252.9
12
DATA RECORD DURING REWRITING
253.12
68
THE 68TH DATA RECORD
253.11
67
THE 67TH DATA RECORD
253.10
66
THE 66TH DATA RECORD
253.9

FIG. 12

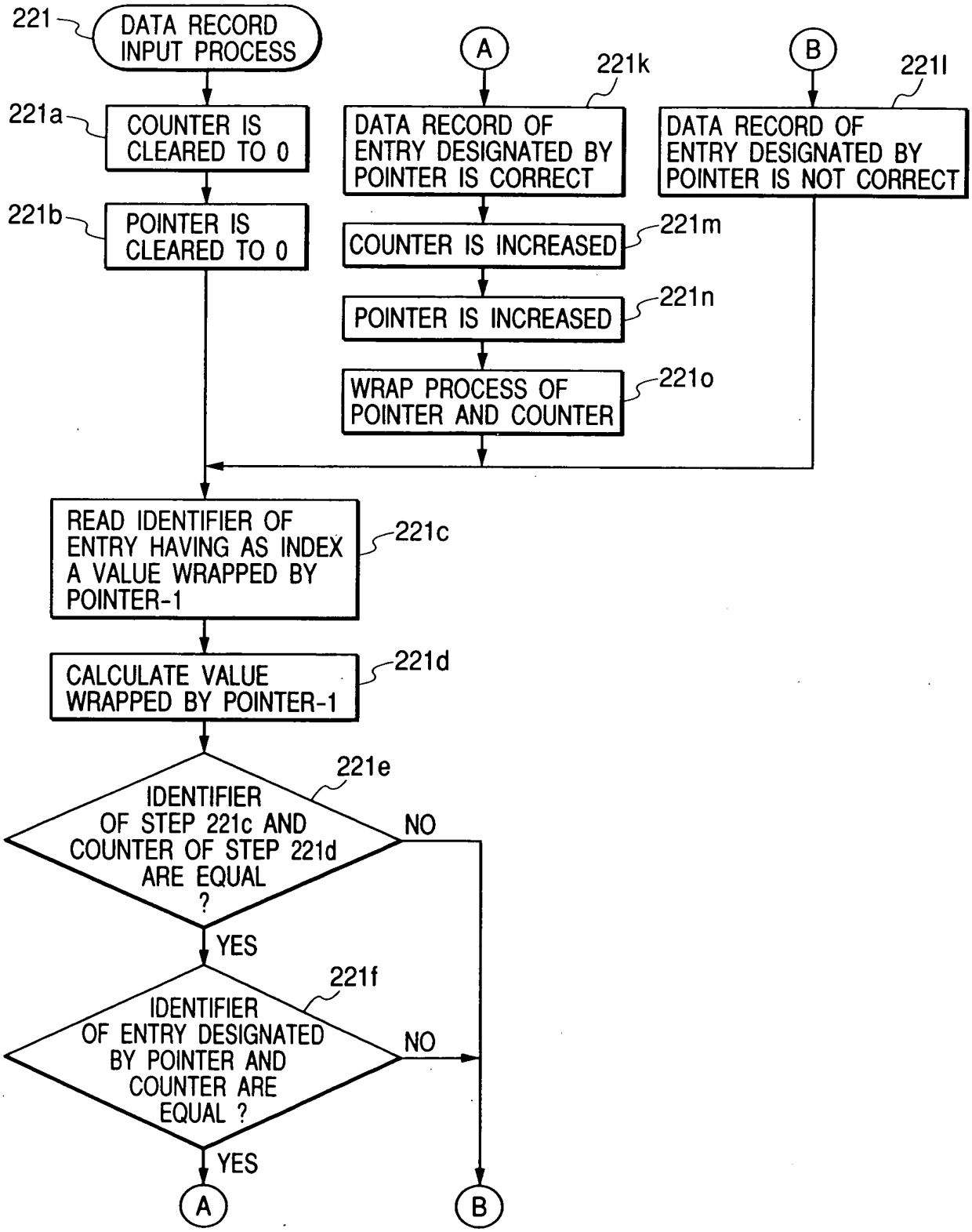

221
DATA RECORD INPUT PROCESS
221a
COUNTER IS CLEARED TO 0
221b
POINTER IS CLEARED TO 0
A
221k
DATA RECORD OF ENTRY DESIGNATED BY POINTER IS CORRECT
B
221l
DATA RECORD OF ENTRY DESIGNATED BY POINTER IS NOT CORRECT
COUNTER IS INCREASED
221m
POINTER IS INCREASED
221n
WRAP PROCESS OF POINTER AND COUNTER
221o
READ IDENTIFIER OF ENTRY HAVING AS INDEX A VALUE WRAPPED BY POINTER-1
221c
CALCULATE VALUE WRAPPED BY POINTER-1
221d
IDENTIFIER OF STEP 221c AND COUNTER OF STEP 221d ARE EQUAL ?
221e
NO
YES
IDENTIFIER OF ENTRY DESIGNATED BY POINTER AND COUNTER ARE EQUAL ?
221f
NO
YES
A
B

FIG. 13

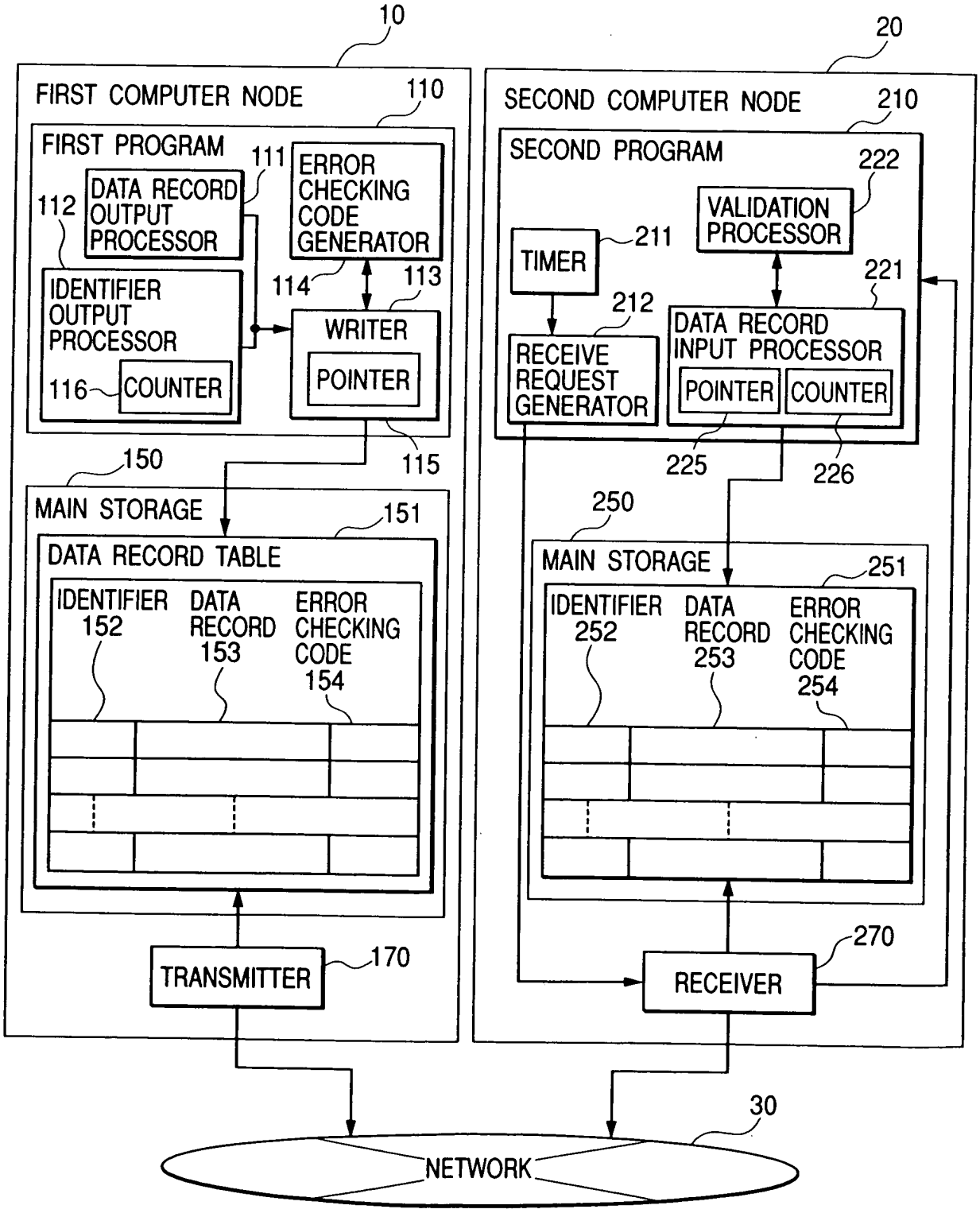

10
FIRST COMPUTER NODE
110
FIRST PROGRAM
111
DATA RECORD OUTPUT PROCESSOR
ERROR CHECKING CODE GENERATOR
112
IDENTIFIER OUTPUT PROCESSOR
114
113
WRITER
116
COUNTER
POINTER
115
150
MAIN STORAGE
151
DATA RECORD TABLE
IDENTIFIER 152
DATA RECORD 153
ERROR CHECKING CODE 154
TRANSMITTER
170
20
SECOND COMPUTER NODE
210
SECOND PROGRAM
222
VALIDATION PROCESSOR
TIMER
211
221
212
DATA RECORD INPUT PROCESSOR
RECEIVE REQUEST GENERATOR
POINTER
COUNTER
225
226
250
MAIN STORAGE
251
IDENTIFIER 252
DATA RECORD 253
ERROR CHECKING CODE 254
270
RECEIVER
30
NETWORK

FIG. 14

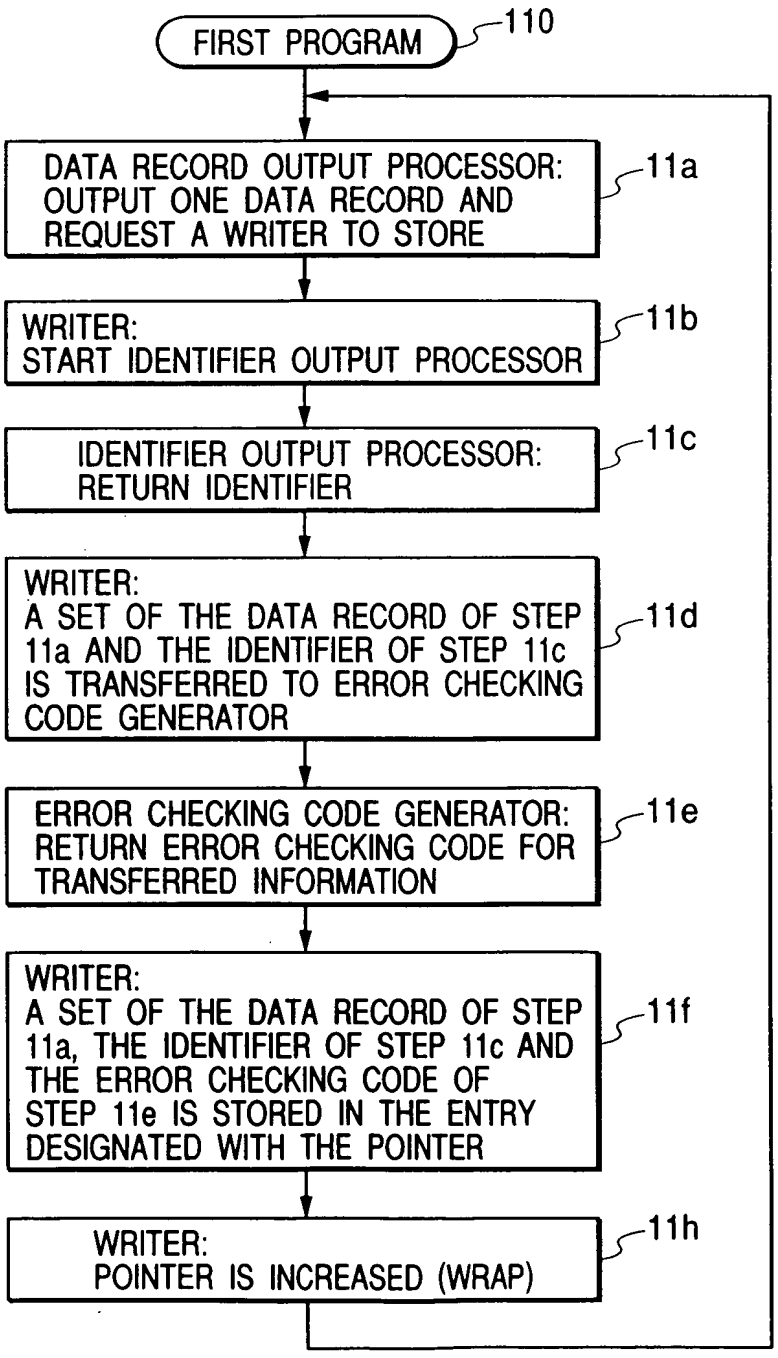

FIRST PROGRAM
110
DATA RECORD OUTPUT PROCESSOR: OUTPUT ONE DATA RECORD AND REQUEST A WRITER TO STORE
11a
WRITER: START IDENTIFIER OUTPUT PROCESSOR
11b
IDENTIFIER OUTPUT PROCESSOR: RETURN IDENTIFIER
11c
WRITER: A SET OF THE DATA RECORD OF STEP 11a AND THE IDENTIFIER OF STEP 11c IS TRANSFERRED TO ERROR CHECKING CODE GENERATOR
11d
ERROR CHECKING CODE GENERATOR: RETURN ERROR CHECKING CODE FOR TRANSFERRED INFORMATION
11e
WRITER: A SET OF THE DATA RECORD OF STEP 11a, THE IDENTIFIER OF STEP 11c AND THE ERROR CHECKING CODE OF STEP 11e IS STORED IN THE ENTRY DESIGNATED WITH THE POINTER
11f
WRITER: POINTER IS INCREASED (WRAP)
11h

FIG. 15

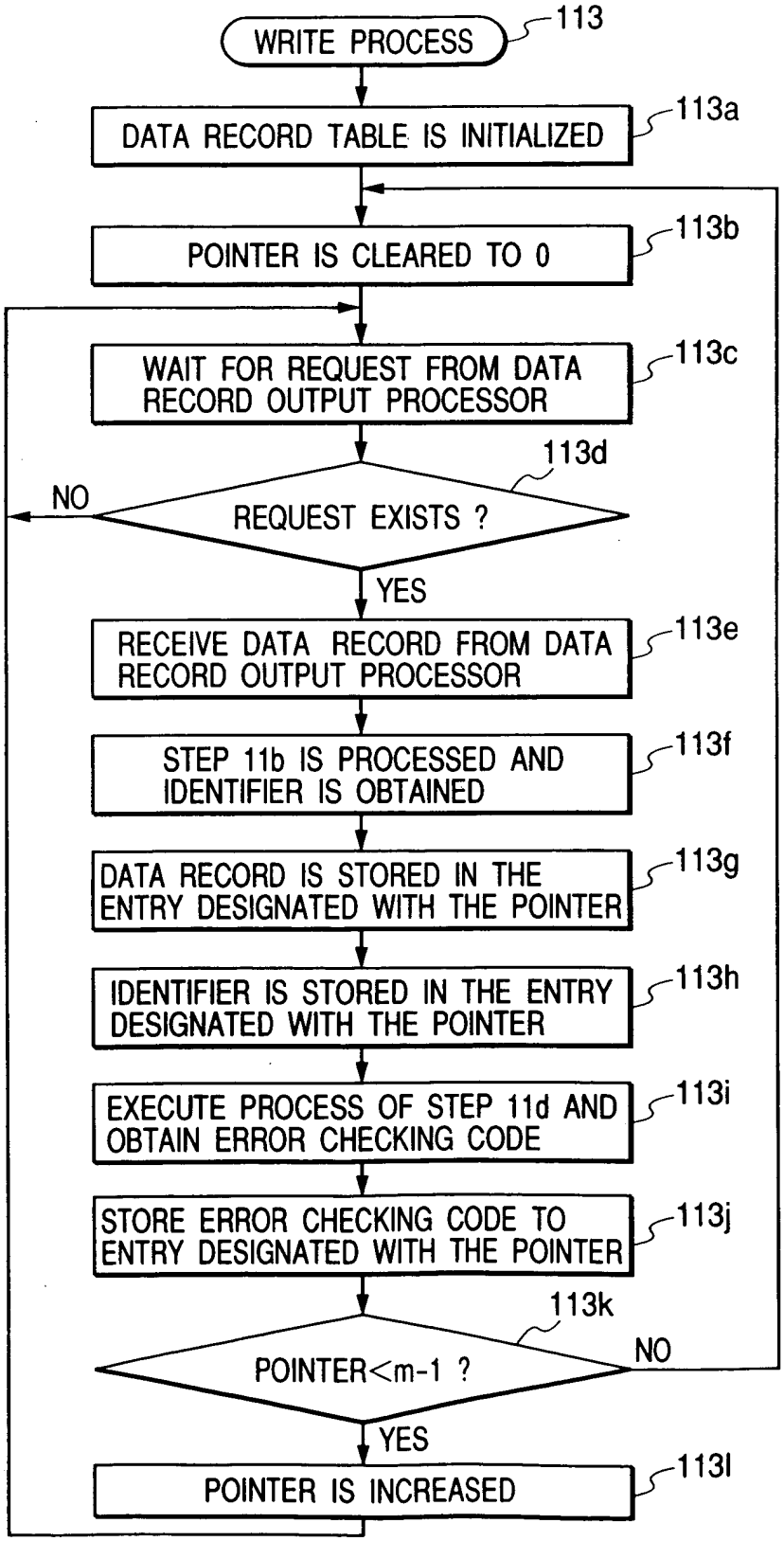

WRITE PROCESS
113
DATA RECORD TABLE IS INITIALIZED
113a
POINTER IS CLEARED TO 0
113b
WAIT FOR REQUEST FROM DATA RECORD OUTPUT PROCESSOR
113c
113d
REQUEST EXISTS ?
NO
YES
RECEIVE DATA RECORD FROM DATA RECORD OUTPUT PROCESSOR
113e
STEP 11b IS PROCESSED AND IDENTIFIER IS OBTAINED
113f
DATA RECORD IS STORED IN THE ENTRY DESIGNATED WITH THE POINTER
113g
IDENTIFIER IS STORED IN THE ENTRY DESIGNATED WITH THE POINTER
113h
EXECUTE PROCESS OF STEP 11d AND OBTAIN ERROR CHECKING CODE
113i
STORE ERROR CHECKING CODE TO ENTRY DESIGNATED WITH THE POINTER
113j
113k
POINTER<m-1 ?
NO
YES
POINTER IS INCREASED
113l

FIG. 16

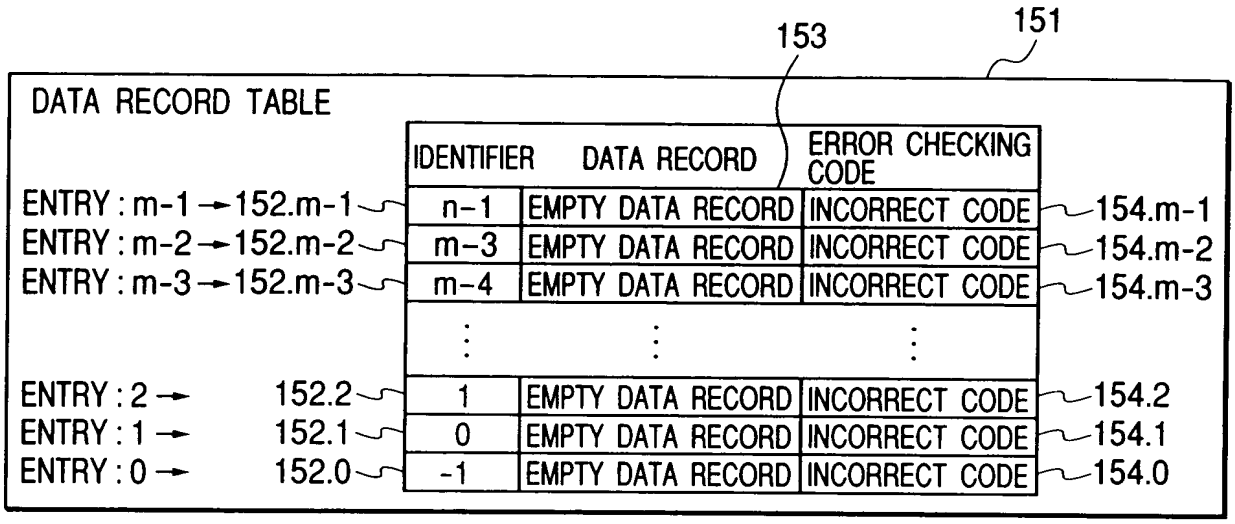

153
151
DATA RECORD TABLE
IDENTIFIER
DATA RECORD
ERROR CHECKING CODE
ENTRY : m-1 → 152.m-1
ENTRY : m-2 → 152.m-2
ENTRY : m-3 → 152.m-3
n-1 EMPTY DATA RECORD INCORRECT CODE 154.m-1
m-3 EMPTY DATA RECORD INCORRECT CODE 154.m-2
m-4 EMPTY DATA RECORD INCORRECT CODE 154.m-3
ENTRY : 2 → 152.2
ENTRY : 1 → 152.1
ENTRY : 0 → 152.0
1 EMPTY DATA RECORD INCORRECT CODE 154.2
0 EMPTY DATA RECORD INCORRECT CODE 154.1
-1 EMPTY DATA RECORD INCORRECT CODE 154.0

FIG. 17

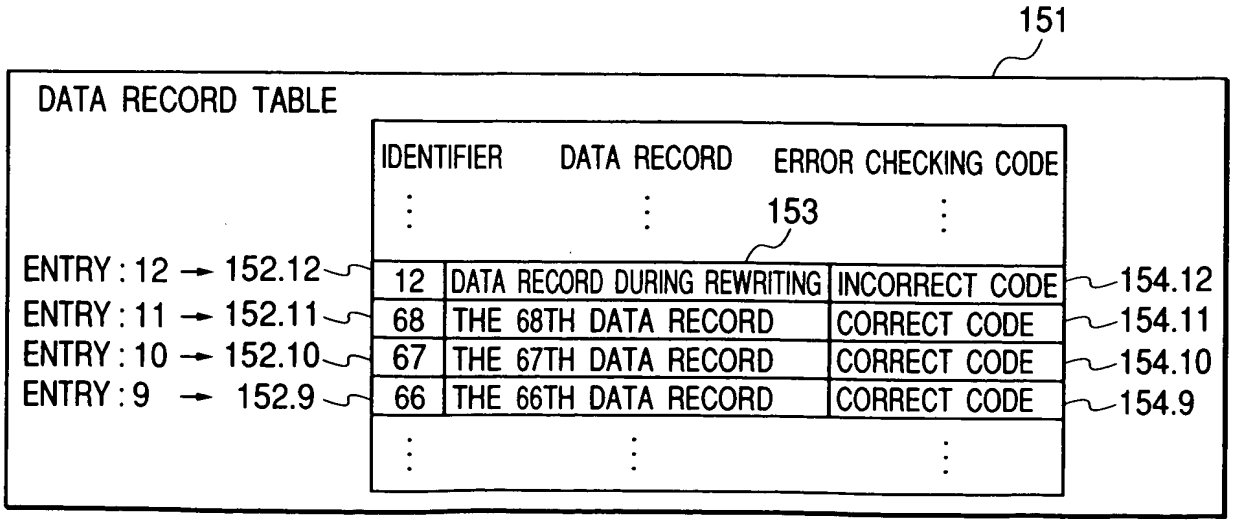

151
DATA RECORD TABLE
IDENTIFIER
DATA RECORD
ERROR CHECKING CODE
153
ENTRY : 12 → 152.12
ENTRY : 11 → 152.11
ENTRY : 10 → 152.10
ENTRY : 9 → 152.9
12 DATA RECORD DURING REWRITING INCORRECT CODE 154.12
68 THE 68TH DATA RECORD CORRECT CODE 154.11
67 THE 67TH DATA RECORD CORRECT CODE 154.10
66 THE 66TH DATA RECORD CORRECT CODE 154.9

FIG. 18

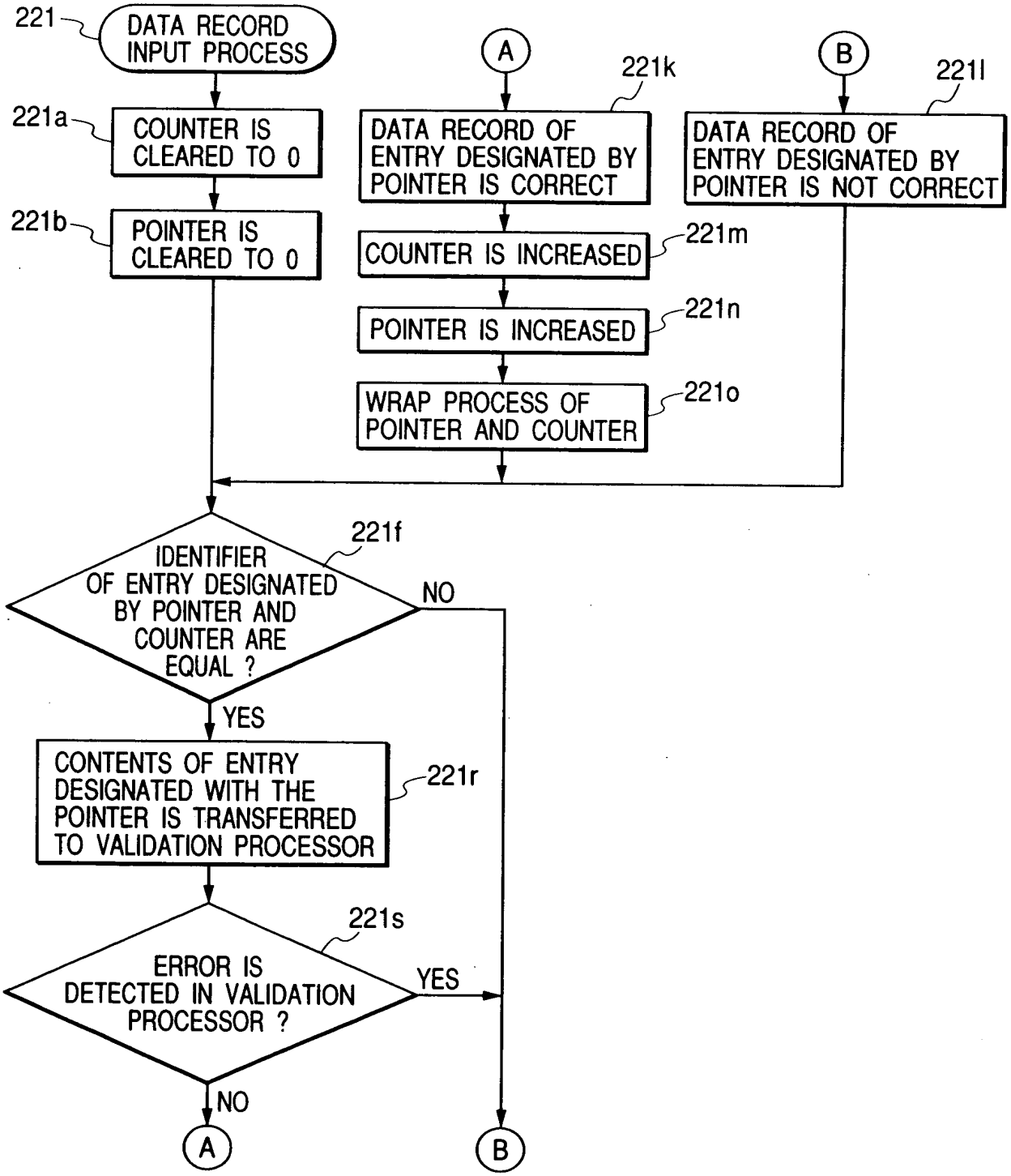

221
DATA RECORD INPUT PROCESS
221a
COUNTER IS CLEARED TO 0
221b
POINTER IS CLEARED TO 0
A
221k
DATA RECORD OF ENTRY DESIGNATED BY POINTER IS CORRECT
B
221l
DATA RECORD OF ENTRY DESIGNATED BY POINTER IS NOT CORRECT
COUNTER IS INCREASED
221m
POINTER IS INCREASED
221n
WRAP PROCESS OF POINTER AND COUNTER
221o
221f
IDENTIFIER OF ENTRY DESIGNATED BY POINTER AND COUNTER ARE EQUAL ?
NO
YES
CONTENTS OF ENTRY DESIGNATED WITH THE POINTER IS TRANSFERRED TO VALIDATION PROCESSOR
221r
221s
ERROR IS DETECTED IN VALIDATION PROCESSOR ?
YES
NO
A
B

FIG. 19

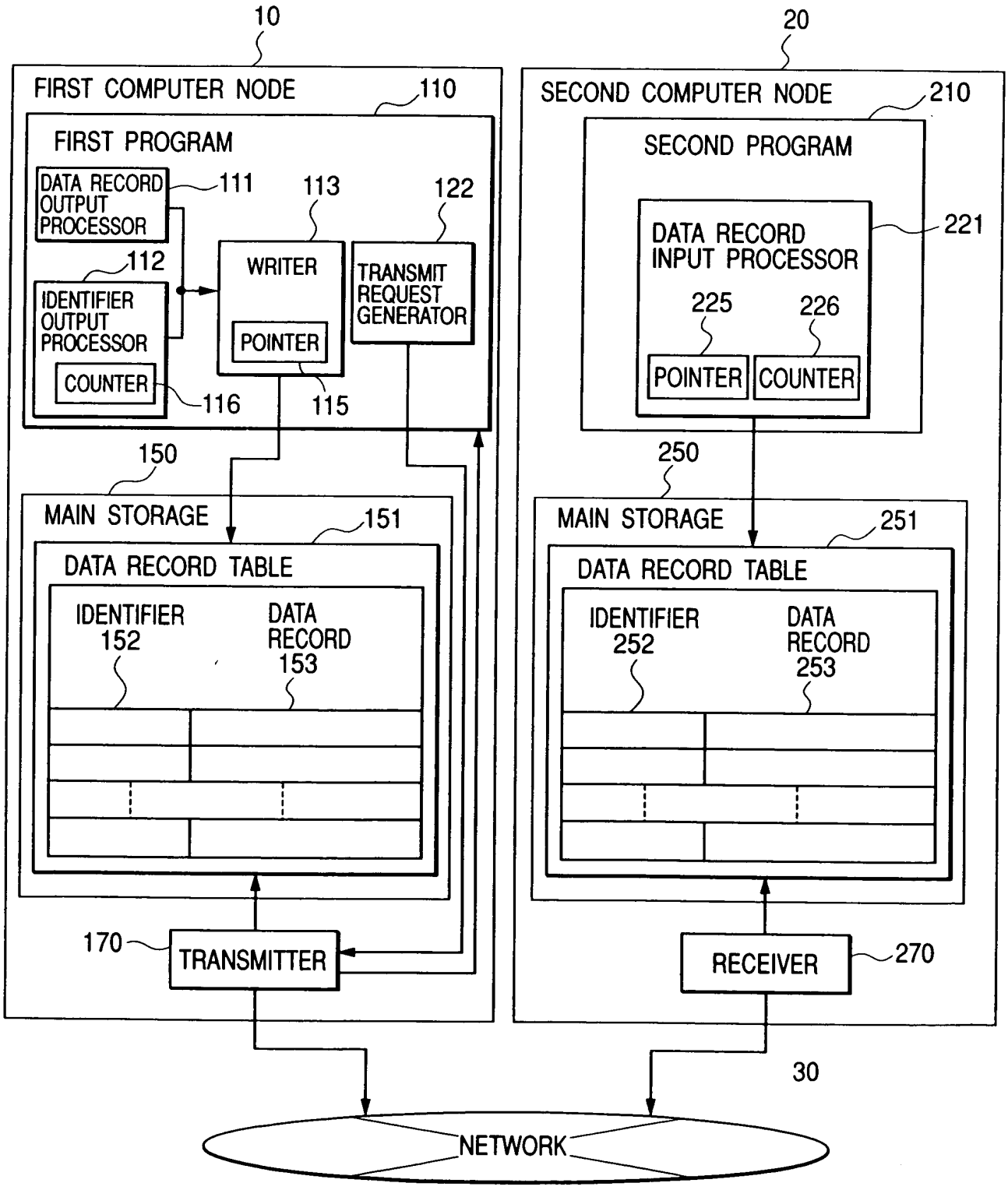

10
FIRST COMPUTER NODE
110
FIRST PROGRAM
DATA RECORD OUTPUT PROCESSOR
111
113
122
112
IDENTIFIER OUTPUT PROCESSOR
WRITER
POINTER
TRANSMIT REQUEST GENERATOR
COUNTER
116
115
150
MAIN STORAGE
151
DATA RECORD TABLE
IDENTIFIER 152
DATA RECORD 153
170
TRANSMITTER
20
SECOND COMPUTER NODE
210
SECOND PROGRAM
DATA RECORD INPUT PROCESSOR
221
225
226
POINTER
COUNTER
250
MAIN STORAGE
251
DATA RECORD TABLE
IDENTIFIER 252
DATA RECORD 253
RECEIVER
270
30
NETWORK

FIG. 20

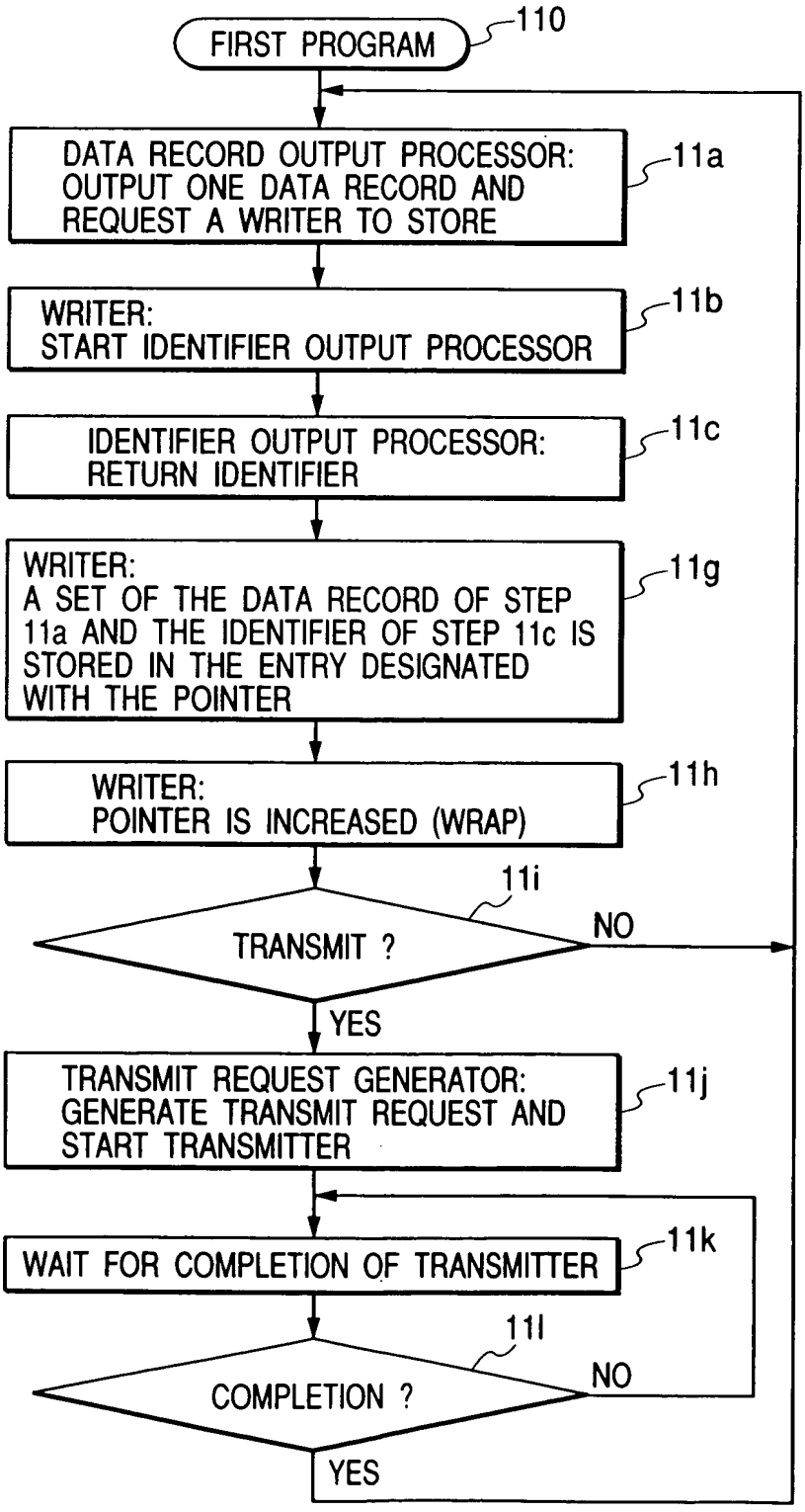

FIRST PROGRAM
110
DATA RECORD OUTPUT PROCESSOR: OUTPUT ONE DATA RECORD AND REQUEST A WRITER TO STORE
11a
WRITER: START IDENTIFIER OUTPUT PROCESSOR
11b
IDENTIFIER OUTPUT PROCESSOR: RETURN IDENTIFIER
11c
WRITER: A SET OF THE DATA RECORD OF STEP 11a AND THE IDENTIFIER OF STEP 11c IS STORED IN THE ENTRY DESIGNATED WITH THE POINTER
11g
WRITER: POINTER IS INCREASED (WRAP)
11h
TRANSMIT ?
11i
NO
YES
TRANSMIT REQUEST GENERATOR: GENERATE TRANSMIT REQUEST AND START TRANSMITTER
11j
WAIT FOR COMPLETION OF TRANSMITTER
11k
COMPLETION ?
11l
NO
YES

FIG. 21

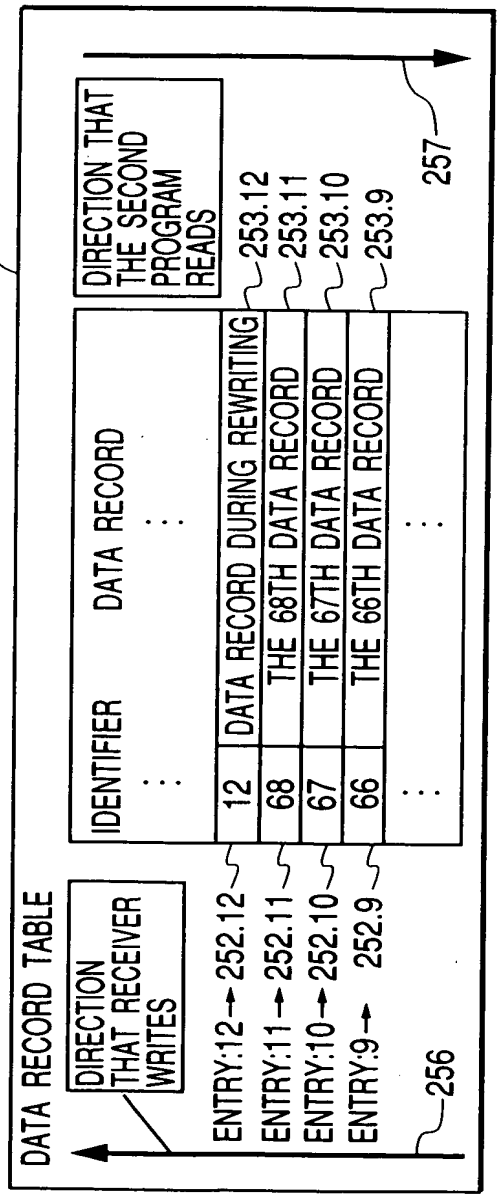

251
DATA RECORD TABLE
DIRECTION THAT RECEIVER WRITES
IDENTIFIER
DATA RECORD
DIRECTION THAT THE SECOND PROGRAM READS
ENTRY:12→ 252.12
ENTRY:11→ 252.11
ENTRY:10→ 252.10
ENTRY:9→ 252.9
12
DATA RECORD DURING REWRITING
253.12
68
THE 68TH DATA RECORD
253.11
67
THE 67TH DATA RECORD
253.10
66
THE 66TH DATA RECORD
253.9
256
257

FIG. 22

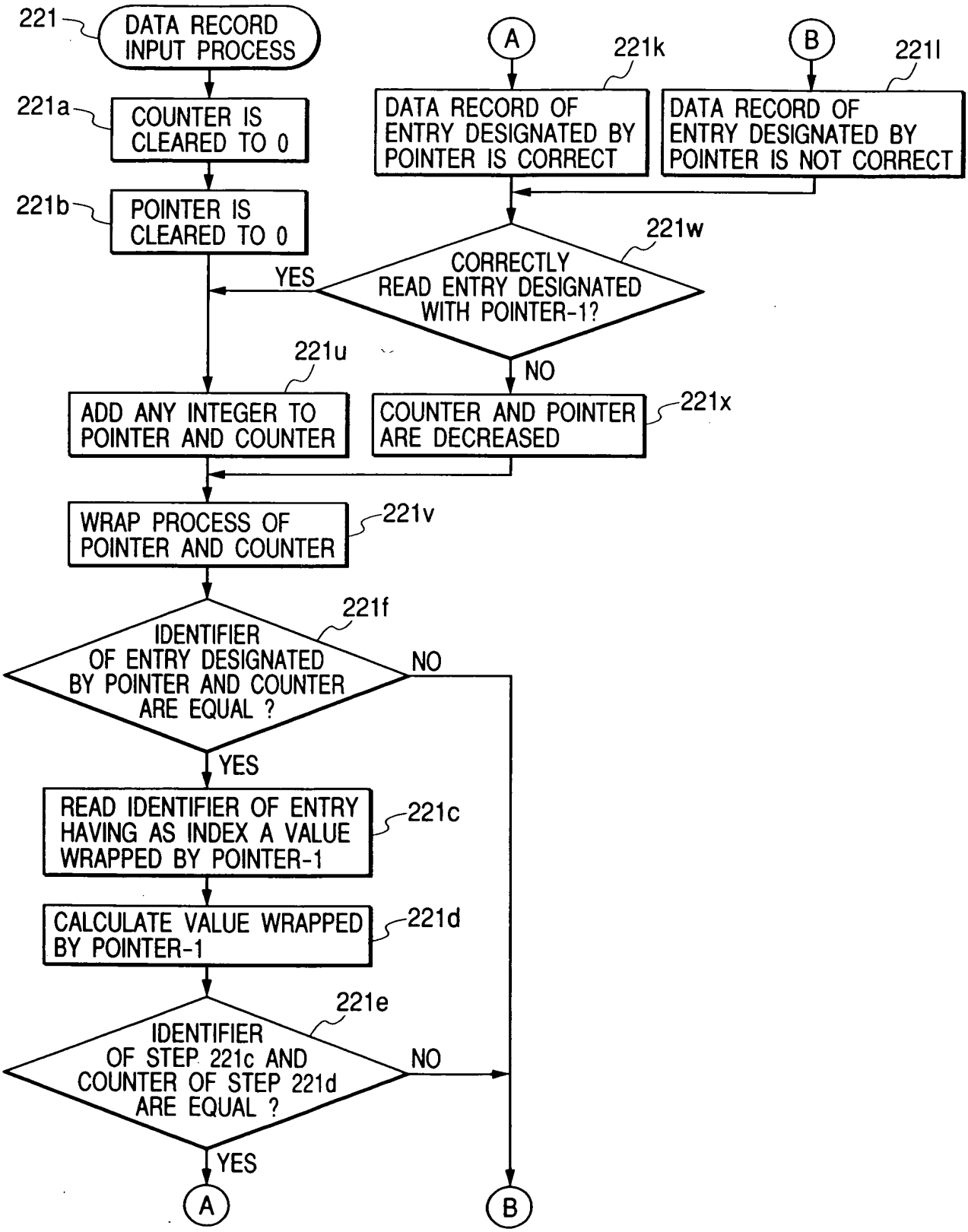

221
DATA RECORD INPUT PROCESS
221a
COUNTER IS CLEARED TO 0
221b
POINTER IS CLEARED TO 0
A
221k
DATA RECORD OF ENTRY DESIGNATED BY POINTER IS CORRECT
B
221l
DATA RECORD OF ENTRY DESIGNATED BY POINTER IS NOT CORRECT
221w
CORRECTLY READ ENTRY DESIGNATED WITH POINTER-1?
YES
NO
221u
ADD ANY INTEGER TO POINTER AND COUNTER
221x
COUNTER AND POINTER ARE DECREASED
221v
WRAP PROCESS OF POINTER AND COUNTER
221f
IDENTIFIER OF ENTRY DESIGNATED BY POINTER AND COUNTER ARE EQUAL ?
NO
YES
221c
READ IDENTIFIER OF ENTRY HAVING AS INDEX A VALUE WRAPPED BY POINTER-1
221d
CALCULATE VALUE WRAPPED BY POINTER-1
221e
IDENTIFIER OF STEP 221c AND COUNTER OF STEP 221d ARE EQUAL ?
NO
YES
A
B

FIG. 23

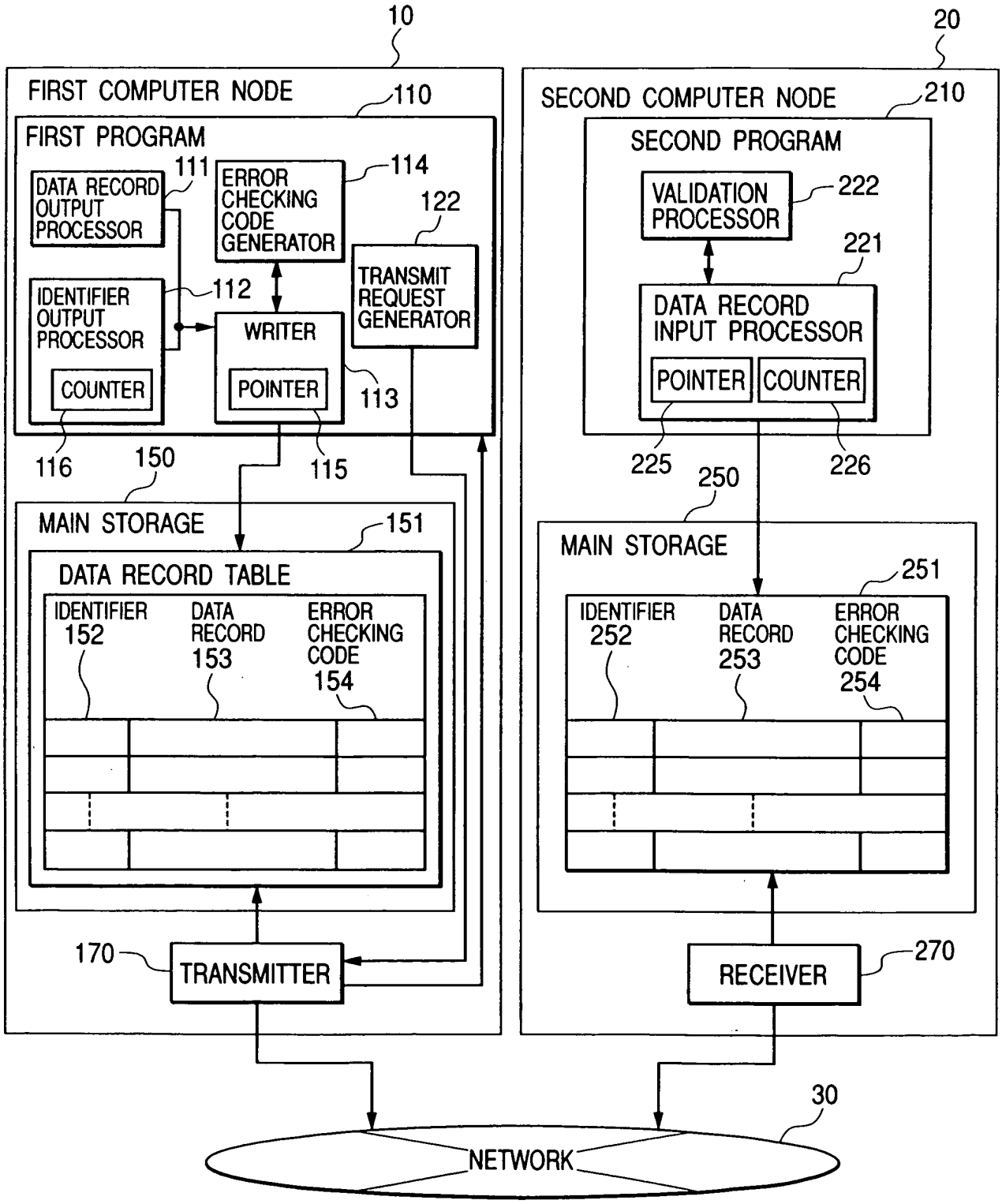

10
FIRST COMPUTER NODE
110
FIRST PROGRAM
DATA RECORD OUTPUT PROCESSOR
111
ERROR CHECKING CODE GENERATOR
114
122
TRANSMIT REQUEST GENERATOR
IDENTIFIER OUTPUT PROCESSOR
112
COUNTER
WRITER
POINTER
113
116
150
115
MAIN STORAGE
151
DATA RECORD TABLE
IDENTIFIER
152
DATA RECORD
153
ERROR CHECKING CODE
154
170
TRANSMITTER
20
SECOND COMPUTER NODE
210
SECOND PROGRAM
VALIDATION PROCESSOR
222
221
DATA RECORD INPUT PROCESSOR
POINTER
COUNTER
225
226
250
MAIN STORAGE
251
IDENTIFIER
252
DATA RECORD
253
ERROR CHECKING CODE
254
RECEIVER
270
30
NETWORK

FIG. 24

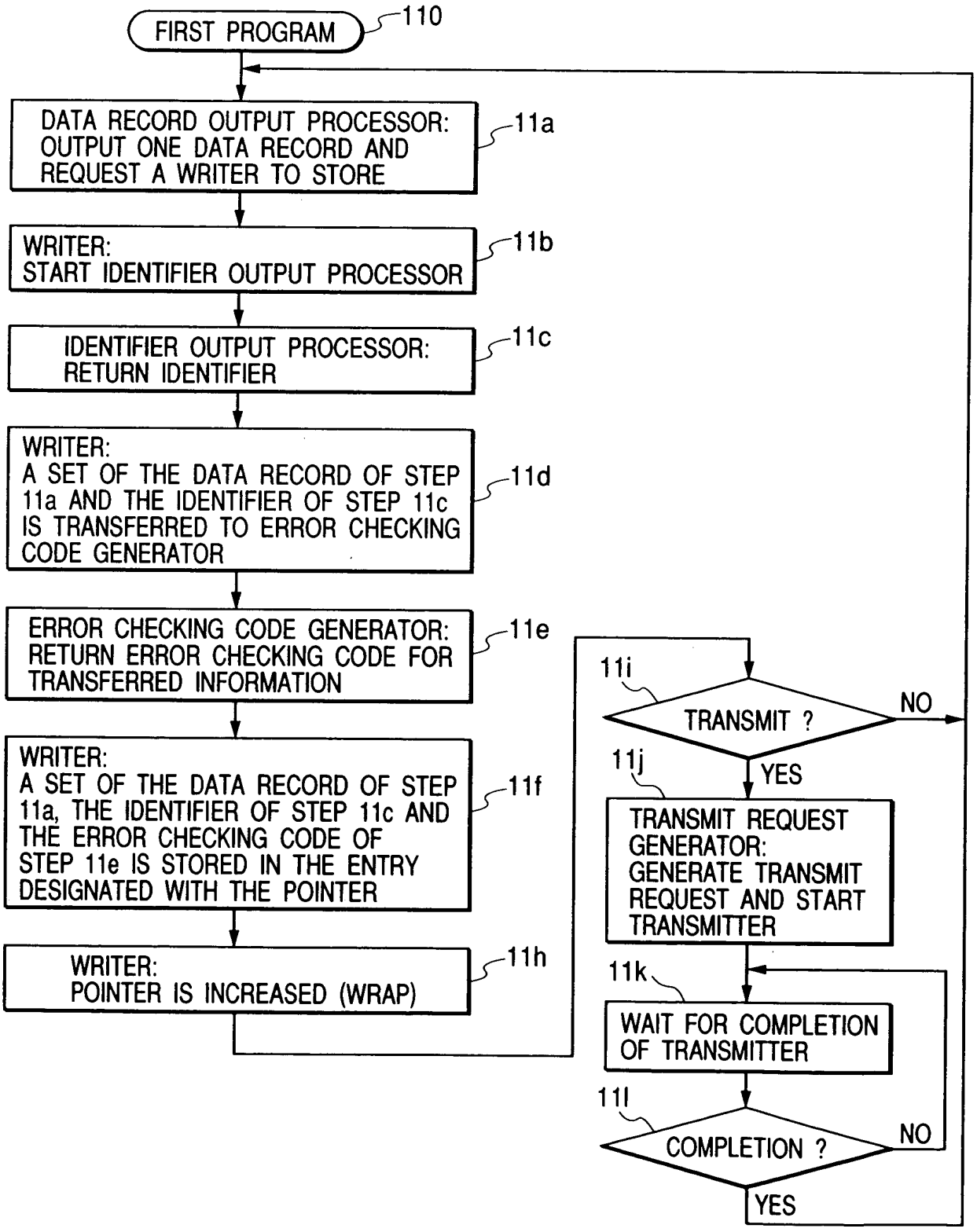

FIRST PROGRAM
110
DATA RECORD OUTPUT PROCESSOR: OUTPUT ONE DATA RECORD AND REQUEST A WRITER TO STORE
11a
WRITER: START IDENTIFIER OUTPUT PROCESSOR
11b
IDENTIFIER OUTPUT PROCESSOR: RETURN IDENTIFIER
11c
WRITER: A SET OF THE DATA RECORD OF STEP 11a AND THE IDENTIFIER OF STEP 11c IS TRANSFERRED TO ERROR CHECKING CODE GENERATOR
11d
ERROR CHECKING CODE GENERATOR: RETURN ERROR CHECKING CODE FOR TRANSFERRED INFORMATION
11e
WRITER: A SET OF THE DATA RECORD OF STEP 11a, THE IDENTIFIER OF STEP 11c AND THE ERROR CHECKING CODE OF STEP 11e IS STORED IN THE ENTRY DESIGNATED WITH THE POINTER
11f
WRITER: POINTER IS INCREASED (WRAP)
11h
11i
TRANSMIT ?
NO
YES
11j
TRANSMIT REQUEST GENERATOR: GENERATE TRANSMIT REQUEST AND START TRANSMITTER
11k
WAIT FOR COMPLETION OF TRANSMITTER
11l
COMPLETION ?
NO
YES

FIG. 25

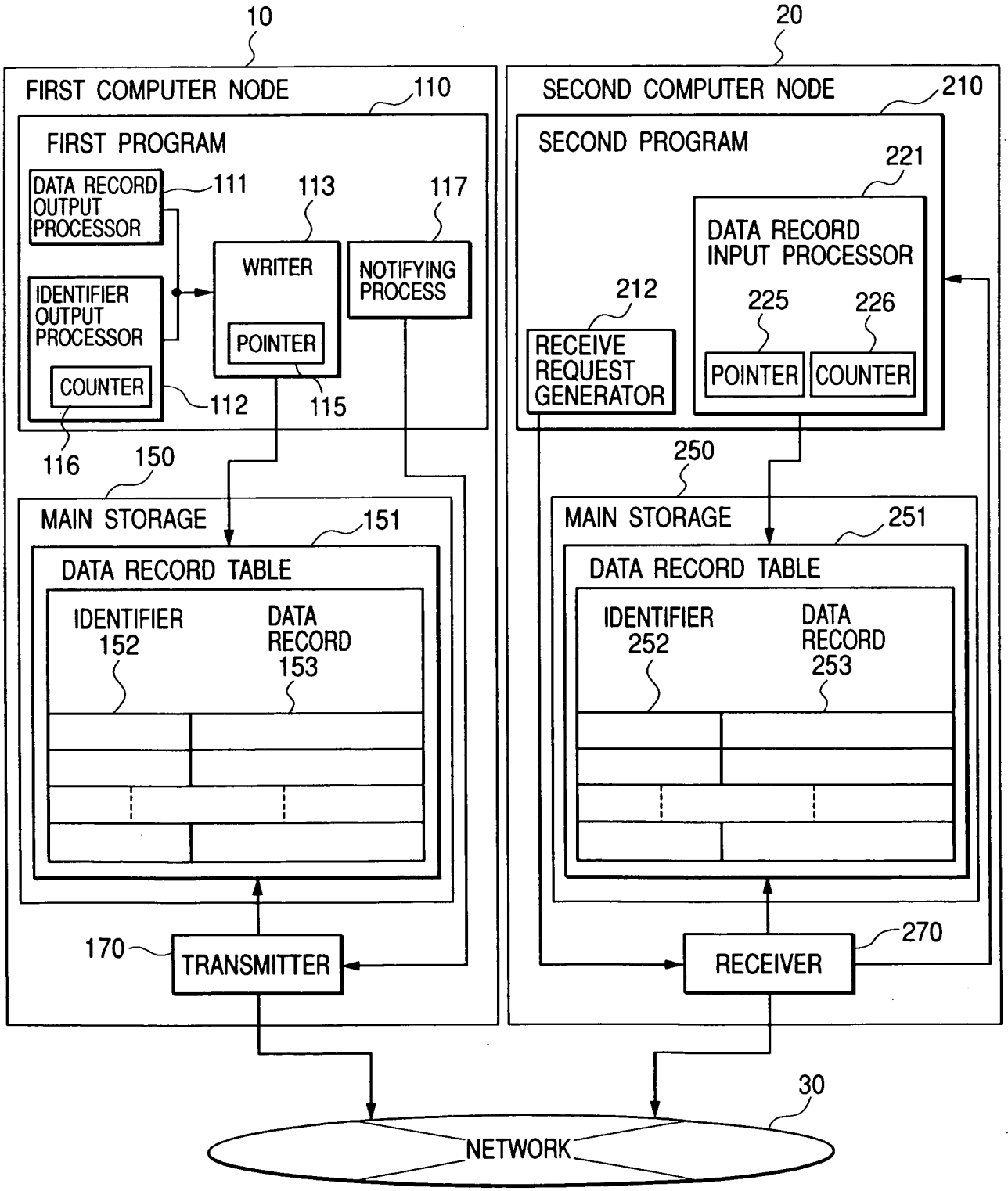

10
20
FIRST COMPUTER NODE
110
SECOND COMPUTER NODE
210
FIRST PROGRAM
SECOND PROGRAM
221
DATA RECORD OUTPUT PROCESSOR
111
113
117
WRITER
NOTIFYING PROCESS
DATA RECORD INPUT PROCESSOR
212
225
226
IDENTIFIER OUTPUT PROCESSOR
POINTER
RECEIVE REQUEST GENERATOR
POINTER
COUNTER
COUNTER
112
115
116
150
250
MAIN STORAGE
151
MAIN STORAGE
251
DATA RECORD TABLE
DATA RECORD TABLE
IDENTIFIER 152
DATA RECORD 153
IDENTIFIER 252
DATA RECORD 253
170
TRANSMITTER
RECEIVER
270
30
NETWORK

FIG. 26

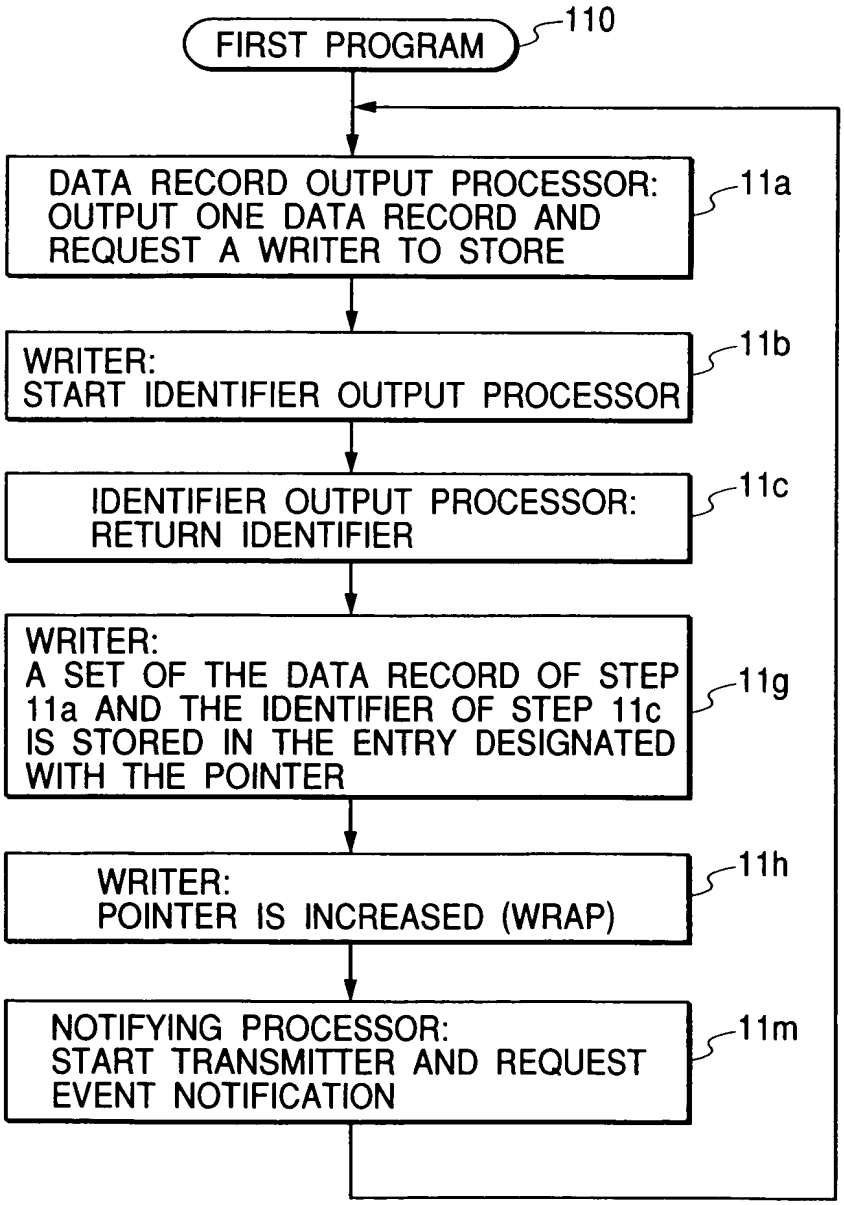

FIRST PROGRAM
110
DATA RECORD OUTPUT PROCESSOR: OUTPUT ONE DATA RECORD AND REQUEST A WRITER TO STORE
11a
WRITER: START IDENTIFIER OUTPUT PROCESSOR
11b
IDENTIFIER OUTPUT PROCESSOR: RETURN IDENTIFIER
11c
WRITER: A SET OF THE DATA RECORD OF STEP 11a AND THE IDENTIFIER OF STEP 11c IS STORED IN THE ENTRY DESIGNATED WITH THE POINTER
11g
WRITER: POINTER IS INCREASED (WRAP)
11h
NOTIFYING PROCESSOR: START TRANSMITTER AND REQUEST EVENT NOTIFICATION
11m

FIG. 27

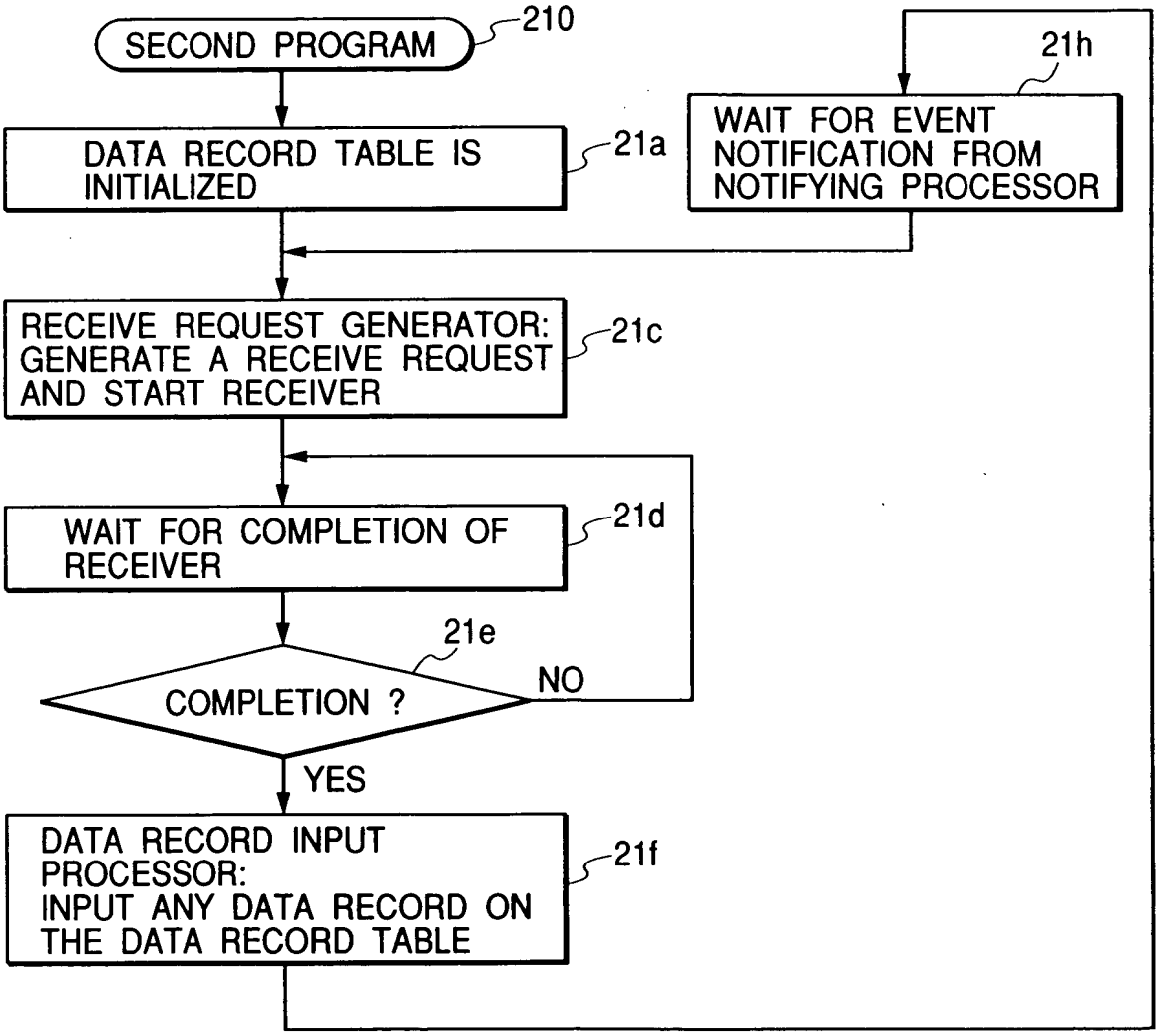

SECOND PROGRAM
210
DATA RECORD TABLE IS INITIALIZED
21a
WAIT FOR EVENT NOTIFICATION FROM NOTIFYING PROCESSOR
21h
RECEIVE REQUEST GENERATOR: GENERATE A RECEIVE REQUEST AND START RECEIVER
21c
WAIT FOR COMPLETION OF RECEIVER
21d
COMPLETION ?
21e
NO
YES
DATA RECORD INPUT PROCESSOR: INPUT ANY DATA RECORD ON THE DATA RECORD TABLE
21f

FIG. 28

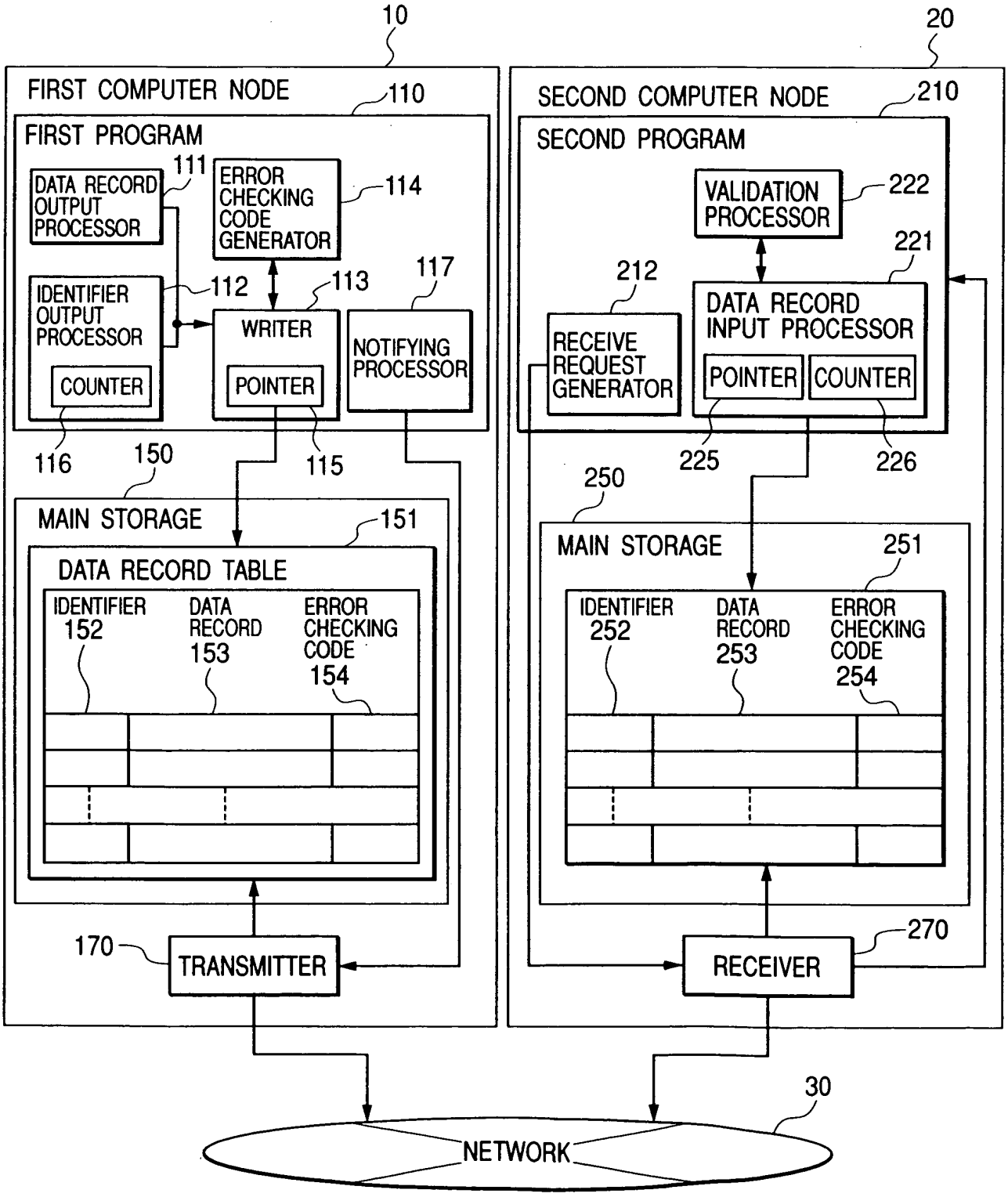

10
20
FIRST COMPUTER NODE
110
SECOND COMPUTER NODE
210
FIRST PROGRAM
SECOND PROGRAM
DATA RECORD OUTPUT PROCESSOR
111
ERROR CHECKING CODE GENERATOR
114
VALIDATION PROCESSOR
222
221
212
IDENTIFIER OUTPUT PROCESSOR
112
113
117
WRITER
NOTIFYING PROCESSOR
DATA RECORD INPUT PROCESSOR
RECEIVE REQUEST GENERATOR
COUNTER
POINTER
POINTER
COUNTER
116
150
115
225
226
250
MAIN STORAGE
151
MAIN STORAGE
251
DATA RECORD TABLE
IDENTIFIER 152
DATA RECORD 153
ERROR CHECKING CODE 154
IDENTIFIER 252
DATA RECORD 253
ERROR CHECKING CODE 254
170
TRANSMITTER
RECEIVER
270
30
NETWORK

FIG. 29

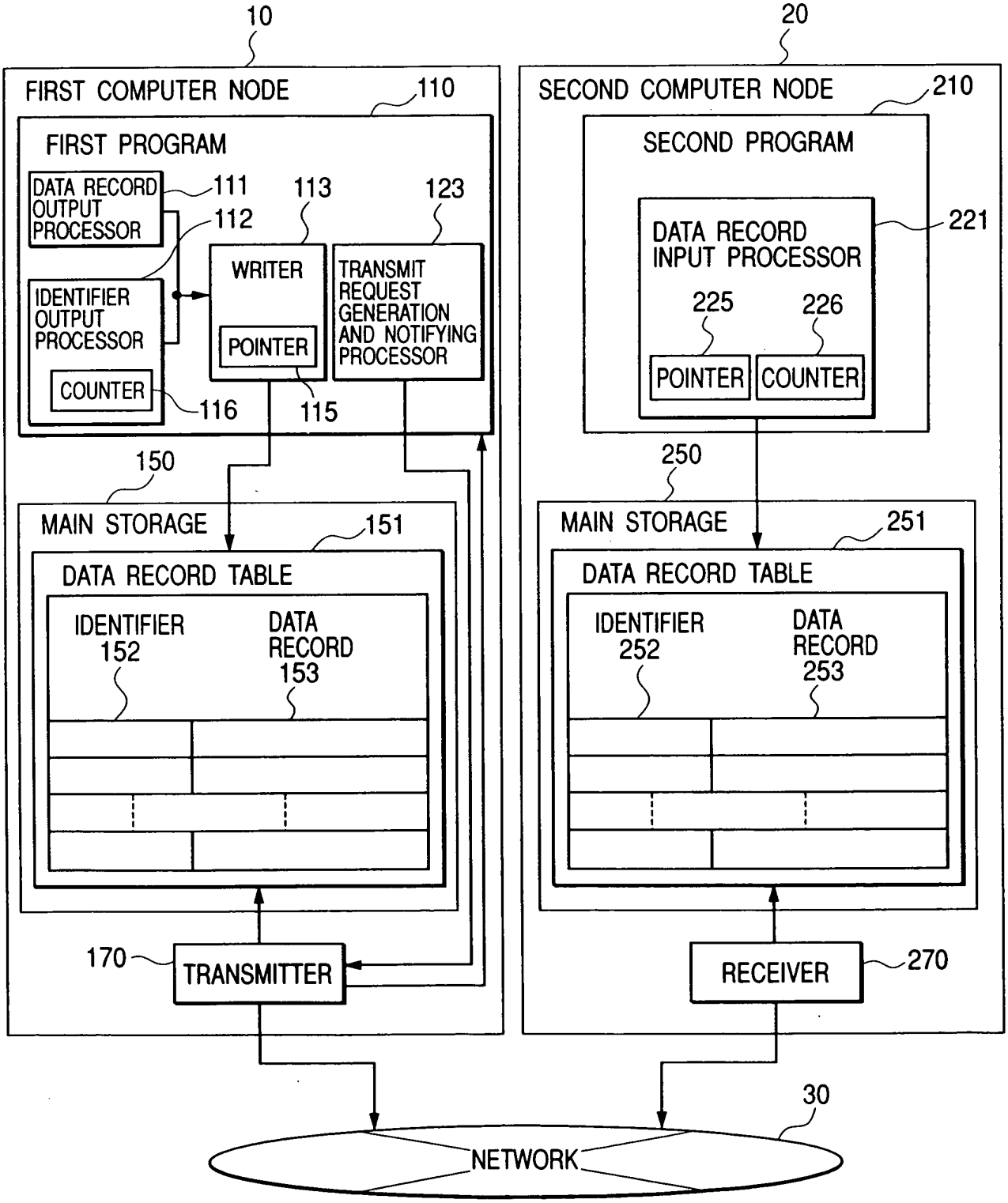

10
FIRST COMPUTER NODE
110
FIRST PROGRAM
DATA RECORD OUTPUT PROCESSOR
111
112
113
123
IDENTIFIER OUTPUT PROCESSOR
WRITER
POINTER
TRANSMIT REQUEST GENERATION AND NOTIFYING PROCESSOR
COUNTER
116
115
150
MAIN STORAGE
151
DATA RECORD TABLE
IDENTIFIER 152
DATA RECORD 153
170
TRANSMITTER
20
SECOND COMPUTER NODE
210
SECOND PROGRAM
DATA RECORD INPUT PROCESSOR
221
225
226
POINTER
COUNTER
250
MAIN STORAGE
251
DATA RECORD TABLE
IDENTIFIER 252
DATA RECORD 253
RECEIVER
270
30
NETWORK

FIG. 30

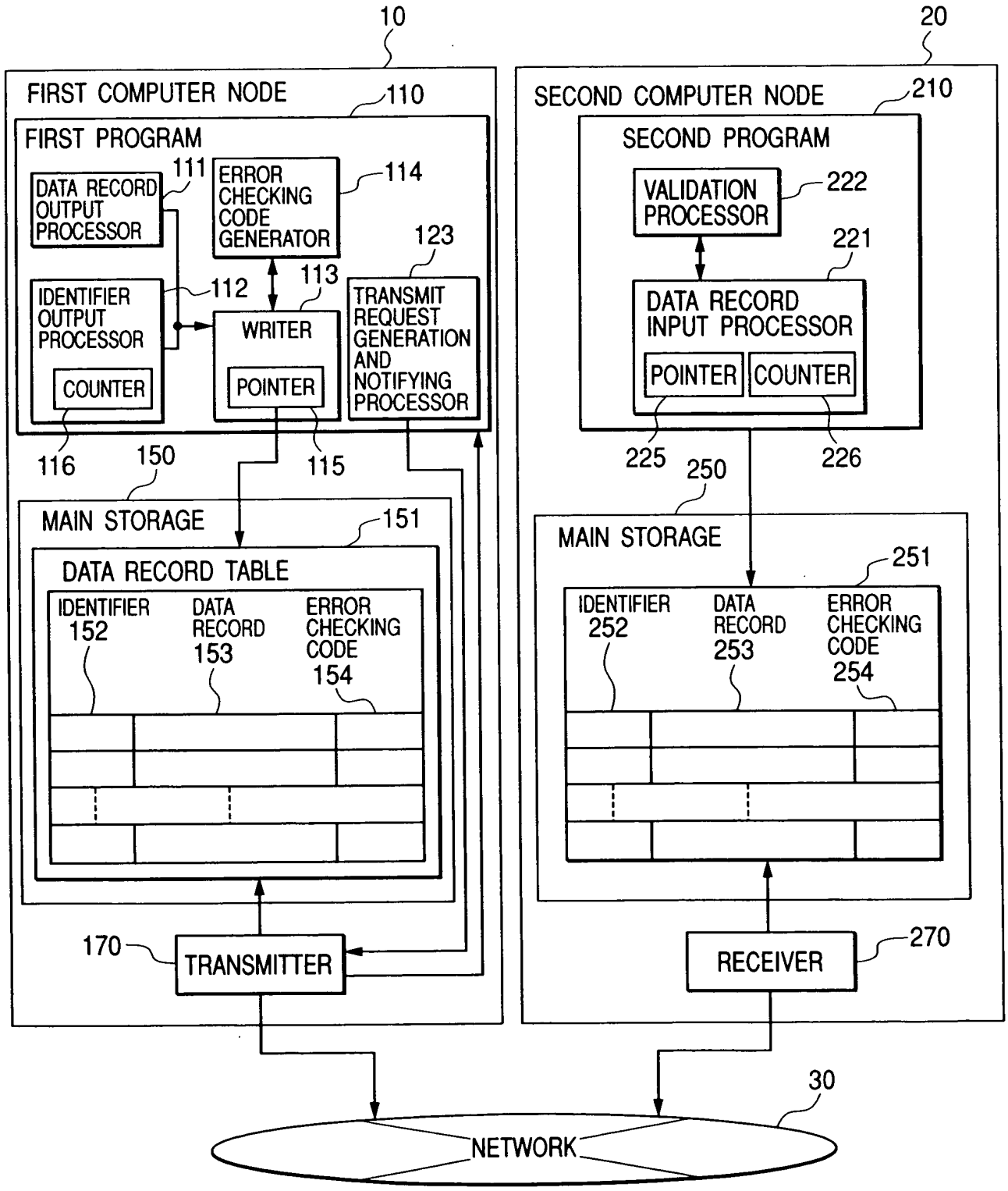

10
20
FIRST COMPUTER NODE
110
SECOND COMPUTER NODE
210
FIRST PROGRAM
SECOND PROGRAM
DATA RECORD OUTPUT PROCESSOR
111
ERROR CHECKING CODE GENERATOR
114
VALIDATION PROCESSOR
222
123
221
IDENTIFIER OUTPUT PROCESSOR
112
113
WRITER
TRANSMIT REQUEST GENERATION AND NOTIFYING PROCESSOR
DATA RECORD INPUT PROCESSOR
COUNTER
POINTER
POINTER
COUNTER
116
150
115
225
250
226
MAIN STORAGE
151
MAIN STORAGE
DATA RECORD TABLE
251
IDENTIFIER
152
DATA RECORD
153
ERROR CHECKING CODE
154
IDENTIFIER
252
DATA RECORD
253
ERROR CHECKING CODE
254
170
TRANSMITTER
RECEIVER
270
30
NETWORK

FIG. 31

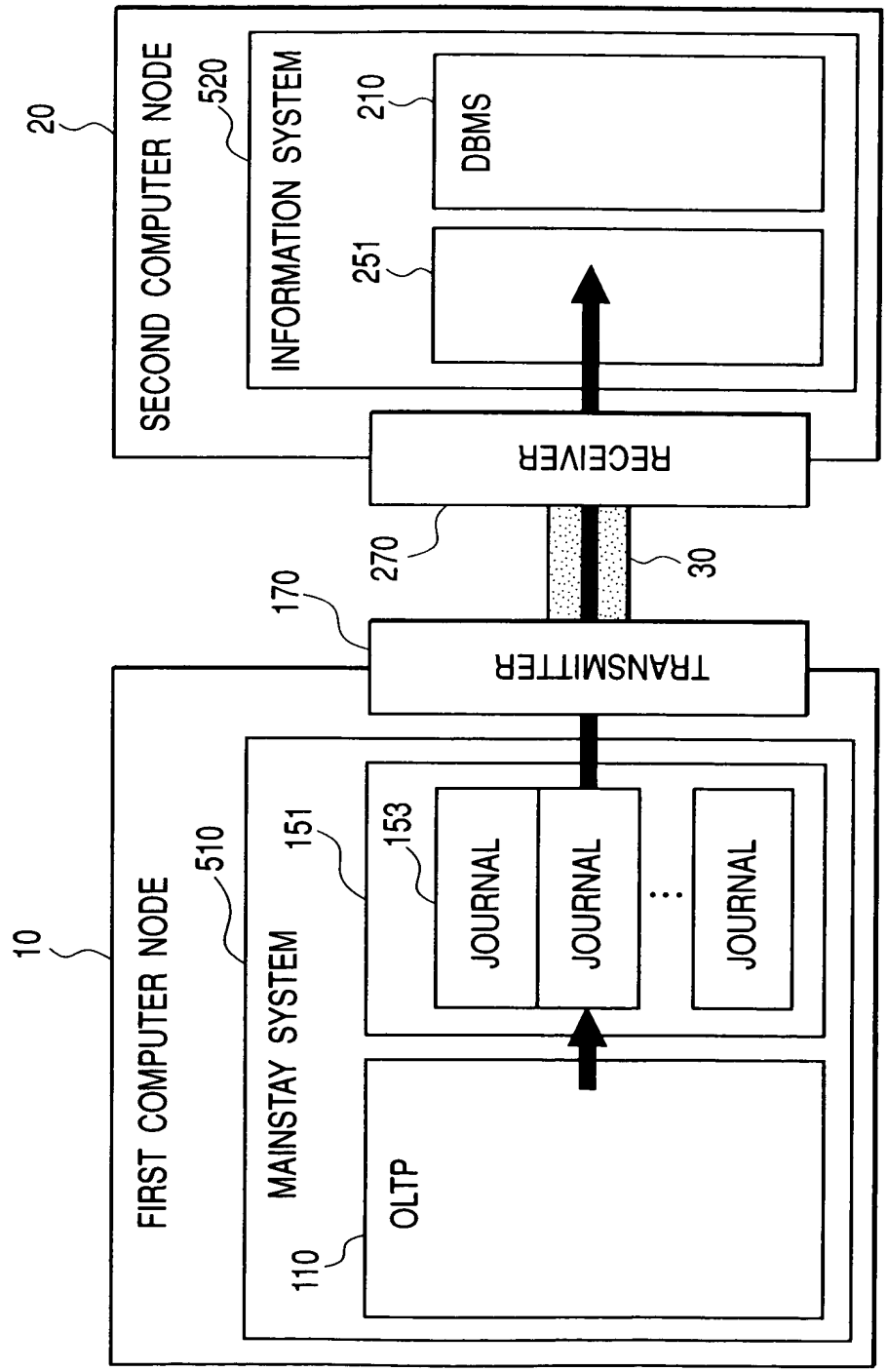
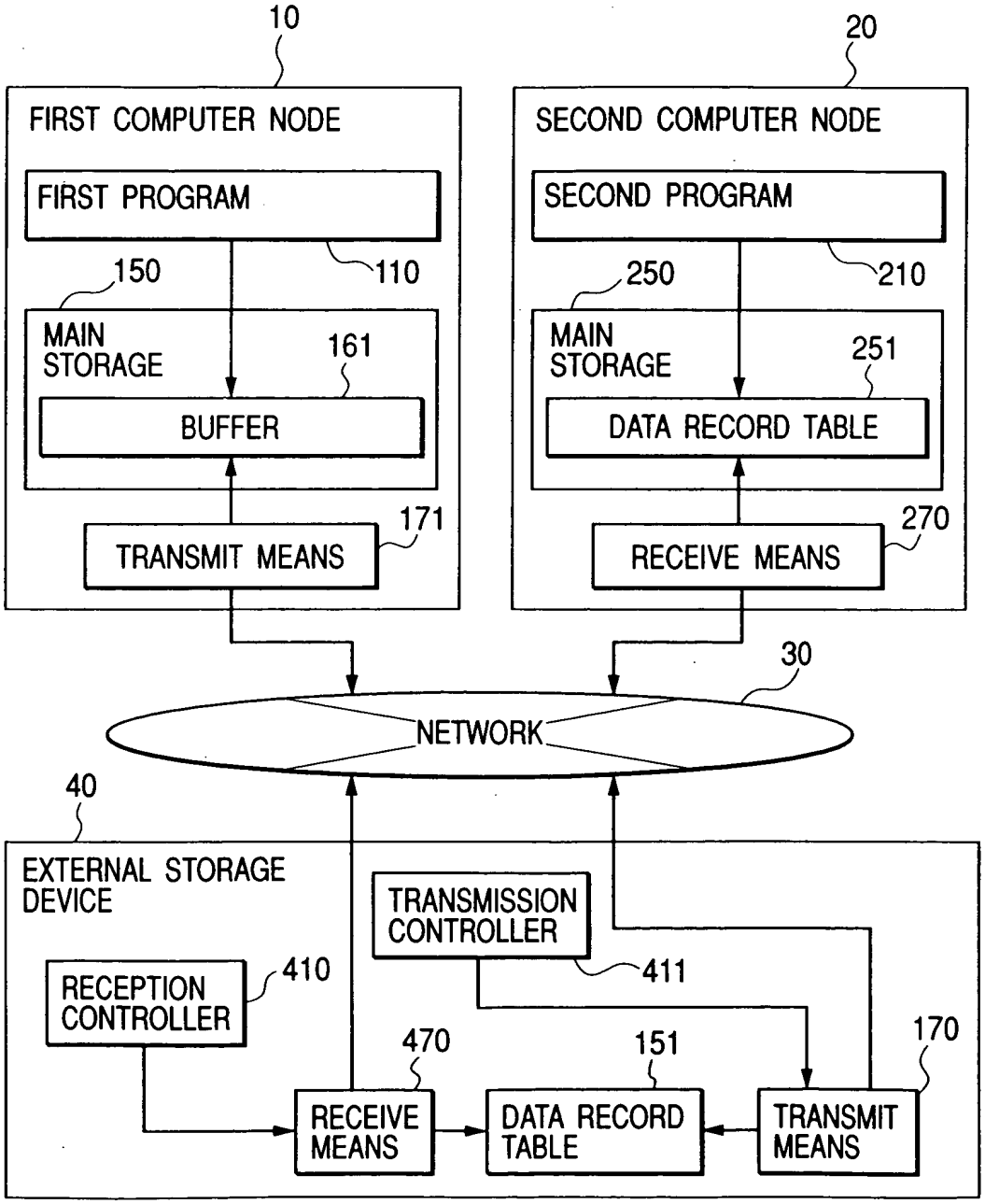

10
FIRST COMPUTER NODE
510
MAINSTAY SYSTEM
151
153
JOURNAL
JOURNAL
JOURNAL
110
OLTP
170
TRANSMITTER
270
30
RECEIVER
20
SECOND COMPUTER NODE
520
INFORMATION SYSTEM
210
DBMS
251

FIG. 32


10
20
FIRST COMPUTER NODE
SECOND COMPUTER NODE
FIRST PROGRAM
SECOND PROGRAM
150
110
250
210
MAIN STORAGE
161
MAIN STORAGE
251
BUFFER
DATA RECORD TABLE
171
270
TRANSMIT MEANS
RECEIVE MEANS
30
NETWORK
40
EXTERNAL STORAGE DEVICE
TRANSMISSION CONTROLLER
411
RECEPTION CONTROLLER
410
470
151
170
RECEIVE MEANS
DATA RECORD TABLE
TRANSMIT MEANS